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NASA

National Aeronautics and
Space Administration

(several)

Budget Estimates

FISCAL YEAR 1991

Volume II

Construction of Facilities

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1991 ESTIMATES

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

GENERAL STATEMENT

The Construction of Facilities (CoF) appropriation provides contractual services for the repair, rehabilitation and modification of existing facilities; the construction of new facilities and the acquisition of related facility equipment; environmental compliance activities; the design of facilities projects; and advanced planning related to future facilities needs.

The funds requested for FY 1991 provide for continuing prior year endeavors to meet facilities requirements for the Space Station Freedom and Space Flight Programs; construction of new facilities needed to support science, space technology and aeronautical research; repair, rehabilitation and modification of other facilities to maintain, upgrade and improve the usefulness of the NASA physical plant; minor construction of new facilities, facility planning and design activities, and environmental compliance and restoration.

The projects and amounts in the budget estimates reflect Space Station Freedom and Space Flight (including the Advanced Solid Rocket Motor Program) facilities requirements that are time-sensitive to meet specific program objectives. Other program requirements for 1991 include construction of an addition to the site electrical substation at the Johnson Space Center; construction of an addition to the Administration and Engineering Building at the Stennis Space Center; construction of a Detector Development Laboratory, initial construction for the Earth Observing Systems Data Information Systems Facility, replacement of chillers in the central heating/refrigeration plant, and replacement/modernization of electrical power feeders at the Goddard Space Flight Center; construction of an Observational Instruments Laboratory and refurbishment of the 25-Foot Space Simulator at the Jet Propulsion Laboratory; restoration of utilities at the Wallops Flight Facility; projects to repair, restore, and modernize NASA's aeronautical research and development facilities at Lewis and Langley Research Centers; construction of a Liquid Hydrogen Structural Test Facility and rehabilitation and modification of the electrical distribution system at the Dryden Flight Research Facility; construction of an addition for a Light-Alloy Research Laboratory at the Langley Research Center; construction of a Space Experiments Laboratory and refurbishment of the Electric Power Laboratory at the Lewis Research Center; construction of a 34-meter multi-frequency antenna, Goldstone, CA; and rehabilitation of the 70-meter antenna drive gear boxes in Australia, Spain, and Goldstone, CA.

The FY 1991 program continues to meet the objectives of preserving and enhancing the capabilities and usefulness of existing facilities and ensuring safe, economical and efficient use of the NASA physical plant. This request continues the necessary rehabilitation and modification program begun in prior years and continues a repair program. The repair program restores facilities to a condition substantially equivalent to their originally designed capability. The minor construction program continues to provide a means to accomplish smaller facility

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projects which accommodate changes in technical and institutional requirements. The environmental compliance and restoration program ensures that statutory environmental requirements are met and any necessary remedial actions are promptly taken.

Funds requested for facility planning and design cover advance planning and design requirements for potential future projects, master planning, facilities studies, engineering reports and studies and the preparation of facility project design drawings and bid specifications.

Three of the four projects previously proposed for private sector financing in FY 1990 are included in the FY 1991 CoF program request. They are the Space Station Processing Facility at the Kennedy Space Center, the Neutral Buoyancy Laboratory at the Johnson Space Center, and the JPL Observational Instruments Laboratory at the Jet Propulsion Laboratory. FY 1990 funds were appropriated for the fourth project, the Advanced Solid Rocket Motor (ASRM) production and test facilities, in lieu of private sector financing. Fiscal Year 1989 funds for this project are presently being used to purchase the site at Yellow Creek, MS, from the Tennessee Valley Authority (TVA), and to prepare designs and specifications.

The budget authority requested for FY 1991 is \$497,900,000, with estimated outlays of \$371,208,000.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROPOSED APPROPRIATION LANGUAGE

CONSTRUCTION OF FACILITIES

[(INCLUDING TRANSFER OF FUNDS)]

For construction, repair, rehabilitation and modification of facilities, minor construction of new facilities and additions to existing facilities, and for facility planning and design not otherwise provided, for the National Aeronautics and Space Administration, and for the acquisition or condemnation of real property, as authorized by law, [\$601,900,000] \$497,900,000, to remain available until September 30, [1992] 1993: *Provided*, That, notwithstanding the limitation on the availability of funds appropriated under this heading by this appropriations Act, when any activity has been initiated by the incurrence of obligations therefor, the amount available for such activity shall remain available until expended, except that this provision shall not apply to the amounts appropriated pursuant to the authorization for repair, rehabilitation and modification of facilities, minor construction of new facilities and additions to existing facilities, and facility planning and design: *Provided further*, That no amount appropriated pursuant to this or any other Act may be used for the lease or construction of a new contractor-funded facility for exclusive use in support of a contract or contracts with the National Aeronautics and Space Administration under which the Administration would be required to substantially amortize through payment or reimbursement such contractor investment, unless an appropriations Act specifies the lease or contract pursuant to which such facilities are to be constructed or leased or such facility is otherwise identified in such Act: *Provided further*, That the Administrator may authorize such facility lease or construction, if he determines, in consultation with the Committee on Appropriations, that deferral of such action until the enactment of the next appropriations Act would be inconsistent with the interest of the Nation in aeronautical and space activities: *Provided further*, That up to \$152,000,000 of the funds provided by this paragraph may be transferred to and merged with sums appropriated for "Space flight, control and data communications" and/or "Research and program management": *Provided further*, That of the amounts transferred under the authority of the foregoing proviso, not to exceed \$85,000,000 may be for "Space flight, control and data communications", and not to exceed \$67,000,000 may be for "Research and program management": *Provided further*, That in addition to the foregoing transfers, up to \$25,000,000 of the funds provided by this paragraph may be transferred to and merged with sums appropriated for "Research and development": (Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 1990; additional authorizing legislation to be proposed.)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1991 ESTIMATES

SUMMARY OF BUDGET PLAN BY LOCATION

(Thousands of Dollars)

LOCATION -----	Fiscal Year 1989 -----	Fiscal Year 1990 -----	Fiscal Year 1991 Agency Request -----
Space Station Freedom Facilities.....	---	51,100	40,000
Space Flight Facilities.....	64,960	122,555	165,500
Advanced Launch System Facilities.....	15,000	---	---
John F. Kennedy Space Center.....	---	7,888	---
Lyndon B. Johnson Space Center.....	7,800	2,760	11,000
Marshall Space Flight Center.....	12,540	---	---
John C. Stennis Space Center.....	---	---	3,800
Goddard Space Flight Center.....	3,100	16,370	16,600
Jet Propulsion Laboratory.....	---	5,320	27,200
Wallops Flight Facility.....	---	---	5,200
Aeronautical Facilities Revitalization.....	46,000	54,449	32,600
Ames Research Center.....	---	10,450	---
Dryden Flight Research Facility.....	---	---	22,800
Langley Research Center.....	6,500	6,800	4,600
Lewis Research Center.....	---	---	16,000
Various Locations.....	---	4,800	17,600
Repair.....	22,900	27,200	30,000
Rehabilitation and Modification.....	30,860	35,000	34,000
Minor Construction.....	9,000	10,000	11,000
Facility Planning and Design.....	22,000	26,300	28,000
Environmental Compliance and Restoration.....	26,000	30,000	32,000
	-----	-----	-----
Total Plan.....	266,660 *	410,992	497,900
	=====	=====	=====

* Excludes \$15 million appropriated to CoF for transfer to the Science, Space, and Technology Education Trust Fund.

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1991 ESTIMATES
SUMMARY OF BUDGET PLAN BY COGNIZANT OFFICE

(Thousands of Dollars)

	Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991 Agency Request
Office of Space Flight.....	87,760	184,303	220,300
Office of Space Science and Applications.....	15,640	9,860	56,100
Office of Commercial Programs.....	---	2,200	---
Office of Aeronautics and Space Technology.....	52,500	71,699	68,900
Office of Space Operations.....	---	14,430	17,600
Office of Management.....	110,760	128,500	135,000
	-----	-----	-----
	266,660	410,992	497,900
	=====	=====	=====

SUMMARY OF BUDGET PLAN BY SUBFUNCTION

(Thousands of Dollars)

Code				
253	Space Flight.....	79,960	173,655	205,500
254	Space Science, Applications and Technology.....	12,540	20,640	54,300
255	Supporting Space Activities.....	121,660	155,448	182,100
(250)	Subtotal, General Science, Space and Technology.....	(214,160)	(349,743)	(441,900)
402	Air Transportation.....	52,500	61,249	56,000
		-----	-----	-----
TOTAL.....		266,660 *	410,992	497,900
		=====	=====	=====

* Excludes \$15 million appropriated to CoF for transfer to the Science, Space, and Technology Education Trust Fund.

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1991 ESTIMATES
BUDGET PLAN BY LOCATION AND PROJECT

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(Thousands of Dollars)

CO	BA	SF	INSTALLATION AND PROJECT	Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991 Agency Request	Page No.
-----				---	---	---	---
SPACE STATION FREEDOM FACILITIES AT VARIOUS LOCATIONS:				---	51,100	40,000	
-----				---	---	---	---
SF	1	253	Construction of Neutral Buoyancy Laboratory (JSC).....	---	---	15,000	CF 1-1
SF	1	253	Construction of Space Station Processing Facility (KSC).....	---	---	25,000	CF 1-6
SF	1	253	Construction of Addition for Space Systems Automated Integration and Assembly Facility (JSC).....	---	10,350	---	
SF	1	253	Construction of Addition to Mission Control Center (JSC).....	---	17,550	---	
SF	1	253	Construction of Addition to Simulator/Training Facility (JSC).....	---	3,700	---	
SF	1	253	Construction of Orbital Debris Radar Facility (JSC).....	---	13,650	---	
SF	1	253	Modifications for Expanded Solar Simulation (JSC).....	---	1,950	---	
SF	1	253	Modifications of Process Technology Facility for Space Station (MSFC)	---	3,900	---	
SPACE FLIGHT FACILITIES AT VARIOUS LOCATIONS:				64,960	122,555	165,500	
-----				---	---	---	---
SF	1	253	Construction of Addition for Flight Training and Operations (JSC) ...	---	---	12,000	CF 2-1
SF	1	253	Rehabilitation of Mission Control Center Power and Control Systems (JSC).....	---	---	8,500	CF 2-6
SF	1	253	Construction of Transporter/Canister Facility (KSC).....	---	---	5,500	CF 2-12
SF	1	253	Construct Processing Control Center (KSC).....	---	---	9,400	CF 2-19
SF	1	253	Replace Heating, Ventilating and Air Conditioning System Hypergolic Maintenance Facility (KSC).....	---	---	2,100	CF 2-26
SF	1	253	Replace Operations and Checkout Building West Cooling Tower (KSC)....	---	---	1,000	CF 2-31
SF	1	253	Restoration of Heavy Equipment Area (KSC).....	---	---	900	CF 2-37
SF	1	253	Upgrade Orbiter Processing Facility High Bay Heating Ventilating and Air-Conditioning System (KSC).....	---	---	3,300	CF 2-43
SF	1	253	Upgrade Yundum International Airport to Full Transoceanic Abort Landing Site, Banjul, The Gambia (KSC).....	---	---	3,400	CF 2-49
SF	1	253	Repair Condensate System, Main Manufacturing Building (MAF).....	---	---	900	CF 2-53
SF	1	253	Construct Project Engineering Facility (MSFC).....	---	---	17,000	CF 2-58
SF	1	253	Restoration of Information and Electronic Systems Laboratory (MSFC)..	---	---	4,000	CF 2-63

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1991 ESTIMATES
BUDGET PLAN BY LOCATION AND PROJECT

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(Thousands of Dollars)

CO	BA	SF	INSTALLATION AND PROJECT	Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991 Agency Request	Page No.

SPACE FLIGHT FACILITIES AT VARIOUS LOCATIONS (CONTINUED):							

SF	1	253	Rehabilitation of Hydrogen Transfer Facility (SSC).....	---	---	2,700	CF 2-68
SF	1	253	Restoration of Space Shuttle Main Engine Test Complex "A" (SSC).....	---	---	2,800	CF 2-73
SF	1	253	Construction of Advanced Solid Rocket Motor Program Facilities (Various Locations).....	27,000	79,470	92,000	CF 2-78
SF	1	253	Replace Cooling Towers, Launch Complex 39 Utility Annex (KSC).....	---	4,535	---	
SF	1	253	Replace Launch Complex 39, Pad A Chillers and Controls (KSC).....	---	1,200	---	
SF	1	253	Replace Roofs, Launch Complex 39 (KSC).....	---	10,700	---	
SF	1	253	Replace Vehicle Assembly Building Air Handling Units (KSC).....	---	1,750	---	
SF	1	253	Upgrade Orbiter Modification and Refurbishment Facility to Orbiter Processing Facility #3 (KSC).....	---	18,250	---	
SF	1	253	Modification of High Pressure Industrial Water System (SSC).....	---	1,950	---	
SF	1	253	Replacement of High Pressure Gas Storage Vessels (SSC).....	3,500	2,900	---	
SF	1	253	Construction of National Resource Protection (Various Locations).....	2,600	1,800	---	
SF	1	253	Refurbish Atmospheric Reentry Materials and Structures Evaluation Facility (JSC).....	4,900	---	---	
SF	1	253	Acquisition of Orbiter Access System at the Vandenberg Site (KSC)....	4,660	---	---	
SF	1	253	Construction of Space Shuttle Support Additions to Yundum Airport, Banjul, The Gambia (KSC).....	1,900	---	---	
SF	1	253	Increase Chiller Capacity, Launch Complex 39 Utility Annex (KSC).....	2,300	---	---	
SF	1	253	Rehabilitation of PAD A, Launch Complex 39 (KSC).....	4,600	---	---	
SF	1	253	Modifications for Advanced Engine Development, Test Stand 116 (MSFC).	13,500	---	---	
ADVANCED LAUNCH SYSTEM FACILITIES:				15,000	---	---	
-----				-----	-----	-----	
SF	1	253	Construction of Component and Subsystem Development Test Facility (SSC).....	15,000	---	---	

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CONSTRUCTION OF FACILITIES
FISCAL YEAR 1991 ESTIMATES
BUDGET PLAN BY LOCATION AND PROJECT

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(Thousands of Dollars)

CO	BA	SF	INSTALLATION AND PROJECT	Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991 Agency Request	Page No.
JOHN F. KENNEDY SPACE CENTER				---	7,888	---	
SF	7	255	Refurbish Bridges, Merritt Island.....	---	4,438	---	
SF	2	254	Rehabilitation of Spacecraft Assembly and Encapsulation Facility II..	---	3,450	---	
LYNDON B. JOHNSON SPACE CENTER				7,800	2,760	11,000	
SF	7	255	Construction of Addition to Site Electrical Substation (JSC).....	---	---	11,000	CF 3-1
SF	7	255	Rehabilitation of Central Heating/Cooling Plant.....	---	2,760	---	
SF	7	255	Construction of Auxiliary Chiller Facility.....	7,800	---	---	
MARSHALL SPACE FLIGHT CENTER				12,540	---	---	
SSA	2	254	Modifications to the X-Ray Calibration Facility (XRCF).....	12,540	---	---	
JOHN C. STENNIS SPACE CENTER				---	---	3,800	
SF	7	255	Addition to Administration and Engineering Building	---	---	3,800	CF 4-1
GODDARD SPACE FLIGHT CENTER				3,100	16,370	16,600	
SSA	3	254	Construct Earth Observing System Data Information System Facility....	---	---	8,000	CF 5-1
SSA	2	254	Construction of Detector Development Laboratory.....	---	---	3,100	CF 5-8
SSA	7	255	Replace Chillers, Central Heating/Refrigeration Plant.....	---	---	4,000	CF 5-14
SSA	7	255	Replacement/Modernization Electrical Power Feeders.....	---	---	1,500	CF 5-20
SO	7	255	Construction of Data Operations Facility.....	---	11,830	---	
SSA	2	254	Construction of Materials Quality Assurance Laboratory.....	---	4,540	---	
SSA	7	255	Modifications for Utility Reliability.....	3,100	---	---	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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(Thousands of Dollars)

CO	BA	SF	INSTALLATION AND PROJECT	Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991 Agency Request	Page No.
JET PROPULSION LABORATORY				---	5,320	27,200	
SSA 2	254		Construction of Observational Instruments Laboratory.....	---	---	14,000	CF 6-1
SSA 2	254		Refurbishment of 25-Foot Space Simulator.....	---	---	13,200	CF 6-7
SSA 7	255		Modernization of South Utility Systems.....	---	5,320	---	
WALLOPS FLIGHT FACILITY				---	---	5,200	
SSA 7	255		Restoration of Utilities.....	---	---	5,200	CF 7-1
AERONAUTICAL FACILITIES REVITALIZATION AT VARIOUS LOCATIONS:				46,000	54,449	32,600	
AST 5	402		Modifications to the High Pressure Air System (LaRC).....	---	---	12,000	CF 8-1
AST 5	402		Modifications to Upgrade the 30X60-Foot Wind Tunnel (LaRC).....	---	---	4,000	CF 8-6
AST 5	402		Repairs to the Tunnel Shell, Unitary Plan Wind Tunnel (LaRC).....	---	---	2,700	CF 8-11
AST 5	402		Rehabilitation of Central Air System (LeRC).....	---	---	7,900	CF 8-16
AST 5	402		Rehabilitation of Propulsion Systems Laboratory (LeRC).....	---	---	6,000	CF 8-21
AST 5	402		Construction of 40x80 Drive Motor Roof (ARC).....	---	1,000	---	
AST 5	402		Modifications to Thermo-Physics Facilities (ARC).....	---	4,535	---	
AST 5	402		Modifications to 14X22 Subsonic Wind Tunnel (LaRC).....	---	1,000	---	
AST 5	402		Modifications to National Transonic Facility for Productivity (LaRC).....	---	7,010	---	
AST 5	402		Modifications to 20-Foot Vertical Spin Tunnel (LaRC).....	---	1,875	---	
AST 5	402		Rehabilitation of Central Air System (LeRC).....	---	2,370	---	
AST 5	402		Rehabilitation of Central Refrigeration Equipment (LeRC).....	---	7,100	---	
AST 5	402		Rehabilitation of 8X6 Supersonic and 9X15 Low-Speed Wind Tunnels (LeRC).....	---	6,705	---	
AST 5	402		Rehabilitation of Hypersonic Tunnel (Plum Brook).....	---	4,045	---	
AST 5	402		Repair and Modernization of the 12-Foot Pressure Wind Tunnel (ARC)...	17,420	18,809	---	
AST 5	402		Refurbishment of Hypersonic Facilities Complex (LaRC).....	14,080	---	---	
AST 5	402		Rehabilitation and Modifications to 10X10 Supersonic Wind Tunnel (LeRC).....	14,500	---	---	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1991 ESTIMATES
BUDGET PLAN BY LOCATION AND PROJECT

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(Thousands of Dollars)

CO	BA	SF	INSTALLATION AND PROJECT	Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991 Agency Request	Page No.
AMES RESEARCH CENTER				---	10,450	---	
AST 4	254		Construction of Automation Sciences Research Facility.....	---	10,450	---	
DRYDEN FLIGHT RESEARCH FACILITY				---	---	22,800	
AST 5	402		Construction of Liquid Hydrogen Structural Test Facility.....	---	---	18,800	CF 9-1
AST 7	255		Rehabilitation and Modification of the Electrical Distribution System	---	---	4,000	CF 9-7
LANGLEY RESEARCH CENTER				6,500	6,800	4,600	
AST 5	402		Construction of Addition for Light-Alloy Research Laboratory.....	---	---	4,600	CF 10-1
AST 5	402		Construction of Supersonic/Hypersonic Low Disturbance Tunnel.....	---	6,800	---	
AST 5	402		Modifications to Transonic Dynamics Tunnel Heavy Gas Reclamation System.....	6,500	---	---	
LEWIS RESEARCH CENTER				---	---	16,000	
SO 3	254		Construction of Space Experiments Laboratory.....	---	---	7,100	CF 11-1
AST 4	254		Refurbishment of Electric Power Laboratory.....	---	---	8,900	CF 11-8
VARIOUS LOCATIONS				---	2,600	17,600	
SO	7	255	Construction of 34-Meter Multifrequency Antenna, Goldstone, CA (JPL).	---	---	13,200	CF 12-1
SO	7	255	Rehabilitation of 70-Meter Antenna Drive Gear Boxes in Australia, Spain, and Goldstone, CA (JPL).....	---	---	4,400	CF 12-7
SO	7	255	Modifications for Seismic Safety, Goldstone, CA (JPL).....	---	2,600	---	

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1991 ESTIMATES
BUDGET PLAN BY LOCATION AND PROJECT

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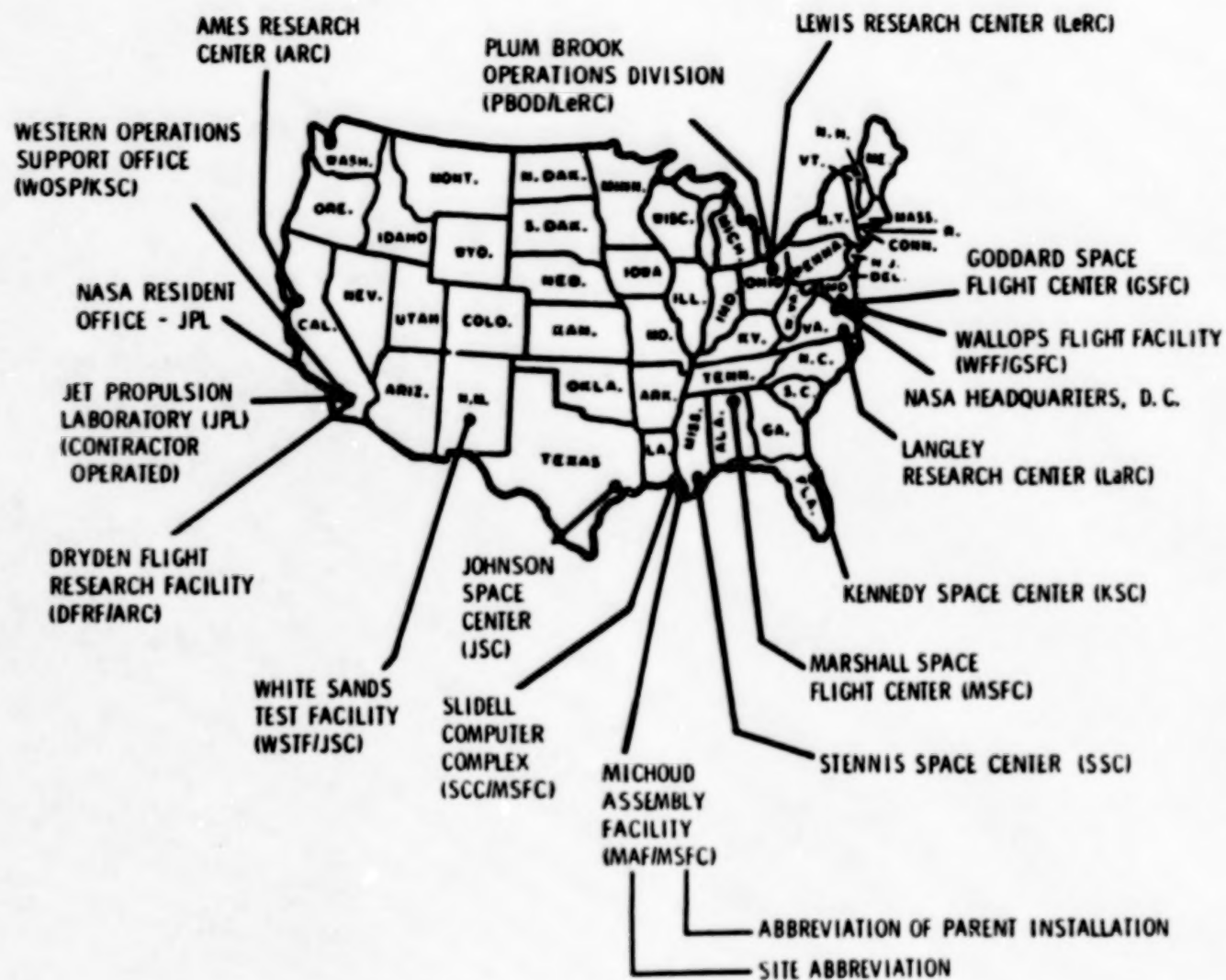
(Thousands of Dollars)

CO	BA	SF	INSTALLATION AND PROJECT	Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991 Agency Request	Page No.
MGT	7	255	REPAIR OF FACILITIES AT VARIOUS LOCATIONS, NOT IN EXCESS OF \$750,000 PER PROJECT.....	22,900	27,200	30,000	CF 13-1
MGT	7	255	REHABILITATION AND MODIFICATION OF FACILITIES AT VARIOUS LOCATIONS NOT IN EXCESS OF \$750,000 PER PROJECT.....	30,860	35,000	34,000	CF 14-1
MGT	7	255	MINOR CONSTRUCTION OF NEW FACILITIES AND ADDITIONS TO EXISTING FACILITIES AT VARIOUS LOCATIONS, NOT IN EXCESS OF \$500,000 PER PROJECT.....	9,000	10,000	11,000	CF 15-1
MGT	7	255	FACILITY PLANNING AND DESIGN.....	22,000	26,300	28,000	CF 16-1
CP	3	254	WAKE SHIELD FACILITY.....	---	2,200	---	
S U B T O T A L , CONSTRUCTION.....				240,660	380,992	465,900	
MGT	7	255	ENVIRONMENTAL COMPLIANCE AND RESTORATION PROGRAM.....	26,000	30,000	32,000	CF 17-1
T O T A L , CONSTRUCTION OF FACILITIES.....				266,660 *	410,992	497,900	

* Excludes \$15 million appropriated to CoF for transfer to the Science, Space, and Technology Education Trust Fund.

SUM 11

LOCATION OF MAJOR AND COMPONENT INSTALLATIONS



SUM 12

RECORDED VALUE OF CAPITAL TYPE PROPERTY
IN-HOUSE AND CONTRACTOR-BUILT
AS OF SEPTEMBER 30, 1969
(DOLLARS IN THOUSANDS)

REAL PROPERTY

REPORTING INSTALLATION	LAND	BUILDING	OTHER STRUCTURES/LEASEHOLD AND FACILITIES IMPROVEMENTS	TOTAL	EQUIPMENT	FIXED ASSETS IN PROGRESS	GRAND TOTAL
AMES RESEARCH CENTER	2929	433579	32217	0	408725	391125	1046683
ARC HOFFETT FIELD, CA.	2900	428349	14399	0	445476	207309	140067
BRIDGES FLIGHT FACILITY EDWARDS, CA.	0	24534	17471	0	42995	77500	139479
VARIOUS LOCATIONS (a)	1	676	347	0	1044	26140	27192
CORBADO SPACE FLIGHT CENTER	2072	170385	129462	0	293719	46067	67739
CSFC - GREENBELT, MD.	1361	112920	20119	0	134400	247984	60004
TRACKING STATIONS NETWORK	5	11340	24646	0	33999	107119	3556
OFF - WILLOPS ISLAND, VA.	1506	45436	71921	0	118063	57707	5299
VARIOUS LOCATIONS (a)	0	601	3776	0	4457	47255	0
JET PROPULSION LABORATORY	1100	125790	109024	1095	237905	406690	113239
JPL - PASADENA, CA.	1100	113534	22064	1000	130614	324053	113239
DEEP SPACE NETWORK	0	12264	87020	7	99291	82637	0
JOHNSON SPACE CENTER	10944	237051	84593	105	333493	405900	10695
JSC - HOUSTON, TX.	7374	196074	53013	0	257261	323241	10695
WHITE SANDS TEST FACILITY LOS CRUCES, NM.	0	10736	26009	105	36050	23961	0
VARIOUS LOCATIONS (a)	3570	30241	5571	0	39302	130770	0
KENNEDY SPACE CENTER	71345	537011	526050	0	1134414	737617	44406
KSC - CAPE CANAVERAL, FL.	71345	537011	526050	0	1134414	84711	44406
WESTERN TEST RANGE, LOMPAC, CA.	0	0	0	0	0	66001	0
VARIOUS LOCATIONS (a)	0	0	0	0	0	506105	0
LANGLEY RESEARCH CENTER	156	194000	392941	0	507105	235135	25076
LARC - HAMPTON, VA.	156	194000	392941	0	507105	210356	25076
VARIOUS LOCATIONS (a)	0	0	0	0	0	16779	0
LEWIS RESEARCH CENTER	8671	207506	92575	136	332030	102068	62020
LERC - CLEVELAND, OH.	316	161099	73513	136	235064	139163	62020
PLUMBROOK, SANDUSKY, OH.	2205	76407	19662	0	97774	25361	0
VARIOUS LOCATIONS (a)	0	0	0	0	0	10339	0
MARSHALL SPACE FLIGHT CENTER	7171	206749	163753	0	477593	523260	2502
MSFC - HUNTSVILLE, AL.	0	137925	70441	0	208366	339142	2502
RICHMOND ASSEMBLY FACILITY, AL.	7102	150675	80130	0	245907	68690	0
SLIDELL COMPUTER COMPLEX, AL.	69	5241	2065	0	8175	7966	0
VARIOUS LOCATIONS (a)	0	4020	10317	0	15145	107454	0
STENNIS SPACE CENTER	10061	104690	207504	0	330263	32012	0
STENNIS SPACE CENTER	10061	104690	207504	0	330263	32012	0
VARIOUS LOCATIONS (a)	0	0	0	0	0	0	0
NSA HEADQUARTERS	0	0	0	0	0	50295	0
NSA - HQS., WASH., D.C.	0	0	0	0	0	26354	0
VARIOUS LOCATIONS (a)	0	0	0	0	0	23941	0
AGENCY TOTAL	117207	2367505	1729157	2136	4211135	3540000	497330

SUM 13

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

SUMMARY

SPACE STATION FREEDOM FACILITIES

	<u>Amount</u> (Dollars)	<u>Page</u> <u>No.</u>
<u>Office of Space Flight:</u>		
Construction of Neutral Buoyancy Laboratory, Johnson Space Center.....	15,000,000	CF 1-1
Construction of Space Station Processing Facility, Kennedy Space Center.....	25,000,000	CF 1-6
Total.....	40,000,000	

CF 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Construction of Neutral Buoyancy Laboratory

INSTALLATION: Johnson Space Center

FY 1991 CoF Estimate: \$15,000,000

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$2,400,000	---	\$2,400,000
Capitalized Investment.....	---	---	---
Total.....	<u>\$2,400,000</u>	<u>---</u>	<u>\$2,400,000</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the initial increment of construction of the Neutral Buoyancy Laboratory to meet the requirements for extravehicular activity (EVA) simulations for astronaut training and EVA procedures development and validation for the Space Station Freedom assembly and operations. EVA activities will be conducted on large Space Station elements. A follow-on increment in FY 1992 will complete the facility.

CF 1-1

PROJECT JUSTIFICATION:

This project is required for EVA simulations for astronaut training and procedures development for the Space Station. A major critical requirement is the validation of EVA timelines to ensure that the EVA activities can be successfully carried out. The Space Station Program will require extensive extravehicular activity for structural buildup and assembly. Water tank facilities have demonstrated successful buoyancy simulation capabilities for EVA. Techniques developed and refined in water tanks allow astronauts in space suits to perform space-related EVA operations on the ground in a manner that correlates closely to the actual on orbit task performance. Existing water tank facilities have been sized for existing program hardware. Now, larger facilities must be provided for the larger Space Station Freedom flight hardware assemblies. The Neutral Buoyancy Laboratory will accommodate the very large space hardware portions and can continue to provide realistic EVA development and operations planning activities during the Space Station build-up and follow-on operations. There are no acceptable neutral buoyancy facilities available for providing adequate Space Station EVA evaluations and astronaut training.

IMPACT OF DELAY:

The Neutral Buoyancy Laboratory is required in this timeframe to support Space Station Freedom hardware design, provide evaluations of concept and prototype hardware for Space Station Freedom assembly, provide input to mission test decisions, provide high-quality preflight evaluation of assembly techniques, and allow astronaut/contractor validation of EVA timelines. Delay in providing this capability will seriously impact the Space Station development. The Neutral Buoyancy Laboratory also will support the Space Transportation System (STS) Orbiter astronaut tasks for the Hubble Space Telescope telescope and other STS servicing missions.

PROJECT DESCRIPTION:

This project provides for excavation, grading, utility connections, reinforced concrete, and structural steel for the initial phases of construction. The laboratory building, of approximately 130,000 square feet will be a steel-framed structure with metal siding containing the neutral buoyancy pool. The pool will be 235 X 135 X 60 feet. A 13,500-square-foot area at one end of the building will be utilized as a test article mockup-assembly area. The facility also will include an area for a mockup handling crane, pool pumping and filter equipment, electrical power, computers, fire detection and suppression, lighting, heating and air-conditioning systems. Included in this facility are test support rooms, laboratories, equipment storage areas, and optional visitors viewing area. Other facility features include service drives, fencing, aboveground and underground utilities, main and secondary service entrances, sidewalks, an outside mockup storage area of approximately 24,000 square feet, a transformer yard, water storage tanks, parking for approximately 150 vehicles, and landscaping. Space will be provided for future exit, air-lock, decompression and hyperbaric chambers. Capability will be provided to permit a pressurized future exit capability from 30 feet below the pool surface.

PROJECT COST ESTIMATE: Based on a preliminary engineering report and partial design.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$15,000,000</u>
Site and Utilities.....	LS	---	---	2,500,000
Office, Laboratory, Observation, Utility.....	LS	---	---	2,300,000
Support, and High Bay Area				
Pool Structure.....	LS	---	---	7,800,000
Mechanical.....	LS	---	---	1,200,000
Electrical.....	LS	---	---	1,200,000
 Total.....				 <u>\$15,000,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Figure 2 - Perspective

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Approximately \$17.0M will be required in FY 1992 to complete this facility.

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF NEUTRAL BUOYANCY LABORATORY

LOCATION PLAN

PROJECT
LOCATION

FOREST LAKE

CLEAR LAKE

AVENUE B

- LEGEND
- EXISTING BUILDINGS AND STRUCTURES EXISTING IN UNDER CONTRACT
 - ROADS AND IMPROVEMENTS EXISTING OR UNDER CONTRACT
 - PROPERTY LINE
 - PAVEMENT LINE
 - AREA OF OCCUPANCY LINE
 - SPRING FENCE
 - SPRING LINE FENCE
 - SPRING
 - TRAIL LINE
 - UNIMPROVED ROADS
 - TEMPORARY FACILITY PRELIMINARY UNIT
 - NEW LIGHT STATION

MASTER SITE PLAN

JOHNSON SPACE CENTER
FISCAL YEAR 1991

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF NEUTRAL BUOYANCY LABORATORY

CUTAWAY PERSPECTIVE

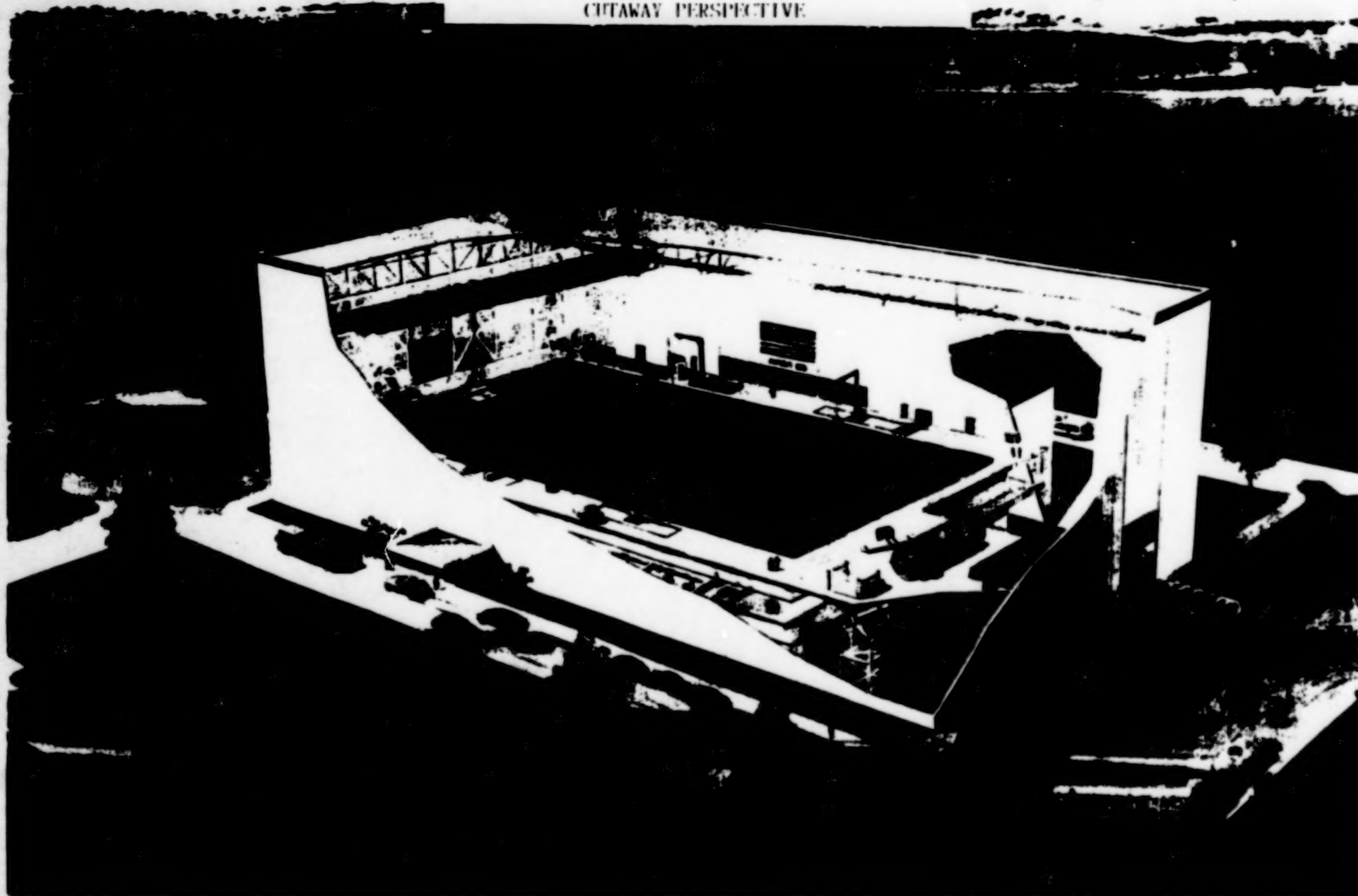


FIGURE 2

CF 1-5

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Construction of Space Station Processing Facility

INSTALLATION: John F. Kennedy Space Center

FY 1991 CoF Estimate: \$25,000,000

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project.

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF funding.....	\$4,822,539	---	\$4,822,539
Capitalized investment.....	---	---	---
Total.....	<u>\$4,822,539</u>	<u>---</u>	<u>\$4,822,539</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of the initial increment of the Space Station Processing Facility (SSPF) for pre-launch and post-landing nonhazardous processing of the various Space Station elements at the Kennedy Space Center (KSC). This increment provides the site preparation, basic building structure for the high bay, airlock, intermediate bay, off-line laboratories, operations control area, support areas for the facility systems and site work. Follow-on increments in FY 1992 and FY 1993 will be required to complete the facility.

PROJECT JUSTIFICATION:

Prelaunch processing is necessary to accomplish post shipment inspection and verification of Space Station elements. This processing ensures that these elements are properly configured for launch, verifies element-to-element interfaces, performs final prelaunch servicing, and verifies on the ground, to extent practicable, the capability of the elements and systems to function as planned in orbit. Unlike payloads/experiments aboard short duration Space Shuttle missions, Space Station elements will be in orbit for extended periods and cannot be easily or inexpensively returned to Earth for correction of system problems or malfunctions. Ground processing of the Space Station elements is extremely critical to achieving the program objectives.

Processing of elements/payloads will begin with their delivery and offloading at KSC. Elements are outfitted and assembled to the extent practicable before delivery to KSC. However, at KSC, final assembly, servicing and verification will be accomplished, and each outfitted element will subsequently be configured and integrated for launch. The final processing operation in this facility will be to install the element in the KSC Shuttle payload canister for transportation to the launch pad and insertion into the Orbiter's cargo bay for launch. The need for processing will continue throughout the operational phase of the Space Station, as certain elements will be regularly returned from orbit for refurbishment, retrofitting, and resupply. Both the U.S. and international logistic modules will require updated processing.

Extensive study and analysis of the Space Station processing requirements revealed that the most cost-effective and efficient means to provide nonhazardous processing of Space Station elements and their experiments is to construct this new facility. Use of the existing Operations and Checkout Building was carefully studied but was determined not to be suitable due to its configuration and continuing requirements for Spacelab and other programs. The SSPF has been sized to support initial components of the Space Station, final assembly, servicing, final tests and closeout, logistics and resupply operations, and payload operations.

Location of this facility near the existing Operations and Checkout Building will provide the opportunity for joint use of specialist checkout personnel (Figures 1 and 2).

IMPACT OF DELAY:

Space Station Freedom processing activities will be "first time" events which have historically resisted timeline compression and delay of this project will result in subsequent slippage of Space Station Freedom operations.

PROJECT DESCRIPTION:

The completed SSPF will enclose a total gross area of approximately 455,000 square feet and house a permanent staff of over 1,500 civil service, contractor, and user personnel (Figure 3). Highly specialized areas will include approximately 73,000 square feet of high bay and intermediate bay floor space for parallel processing of eight Space Station elements in a class 100K clean, controlled environment (Figure 4). Two facility overhead cranes (30-ton, 50-foot maximum hook height) will be provided in the high bay. A 4,200-square-foot airlock (100K clean) will provide high bay access. One 15 ton bridge crane with 45 foot hook height will span the width of the airlock. The processing areas will be provided with compressed air and vacuum systems, gaseous storage and distribution systems, gaseous nitrogen GN_2 and gaseous helium, gaseous vent system for ammonia, high pressure and low pressure applications, and an ultraviolet/infrared fire detection system. The two story off-line support area will contain approximately 320,000 square feet of operational areas (Figures 4, 5, and 6).

General site work, utilities, and facility structure will be completed with the first increment of funding. Site work will include construction of storm drains and GN_2 mains and other mechanical utilities; sanitary, and potable water will be tied into existing utilities. The power and communications duct banks will also be tied into existing utilities. The first increment will also include the building foundations, floor slabs, structural steel, roofing, exterior walls. This increment of funding will also replace the antenna tower for the Payloads Hazardous Servicing Facility to increase tower height to provide an acceptable line-of-sight over the SSPF to the LC-39 launch pads.

The second and third increments of funding in FY 1992 and FY 1993 will include the outfitting of the facility mechanical equipment and electrical distribution systems, final tie-ins and checkouts. Interior architectural systems and final landscaping and parking will also be included.

PROJECT COST ESTIMATE:

The basis of this cost estimate is Facility Studies and Preliminary Engineering Report (PER), Phase III Study, and the 60 percent Design Review.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$25,000,000</u>
Architectural/Structural.....	SF	455,000	23.85	10,850,000
Mechanical.....	SF	455,000	13.18	6,000,000
Electrical.....	SF	455,000	7.03	3,200,000
Site Works and Utilities.....	LS	---	---	2,600,000
Cranes.....	LS	---	---	2,100,000
Antenna Tower.....	---	---	---	250,000
<u>Equipment</u>	---	---	---	---
Total.....				<u>\$25,000,000</u>

Note: The total cost of this project is \$88.0 million.

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Site Plan Figure 3 - Perspective Figure 4 - Plan View - First Floor
Figure 5 - Plan View - Second Floor Figure 6 - Plan View - Third Floor

OTHER EQUIPMENT SUMMARY:

Certain noncollateral equipment to be funded from Research and Development resources and estimated to cost \$349.4 million will be required to support initial SSPF operations.

FUTURE CoF ESTIMATED FUNDING REQUESTED TO COMPLETE THIS PROJECT:

To complete this project, a second increment will be included in the FY 1992 budget request for approximately \$35.0 million and a third increment of \$28.0 million will be included in the FY 1993 budget request.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF SPACE STATION PROCESSING FACILITY

LOCATION PLAN
JOHN F. KENNEDY SPACE CENTER, FLORIDA

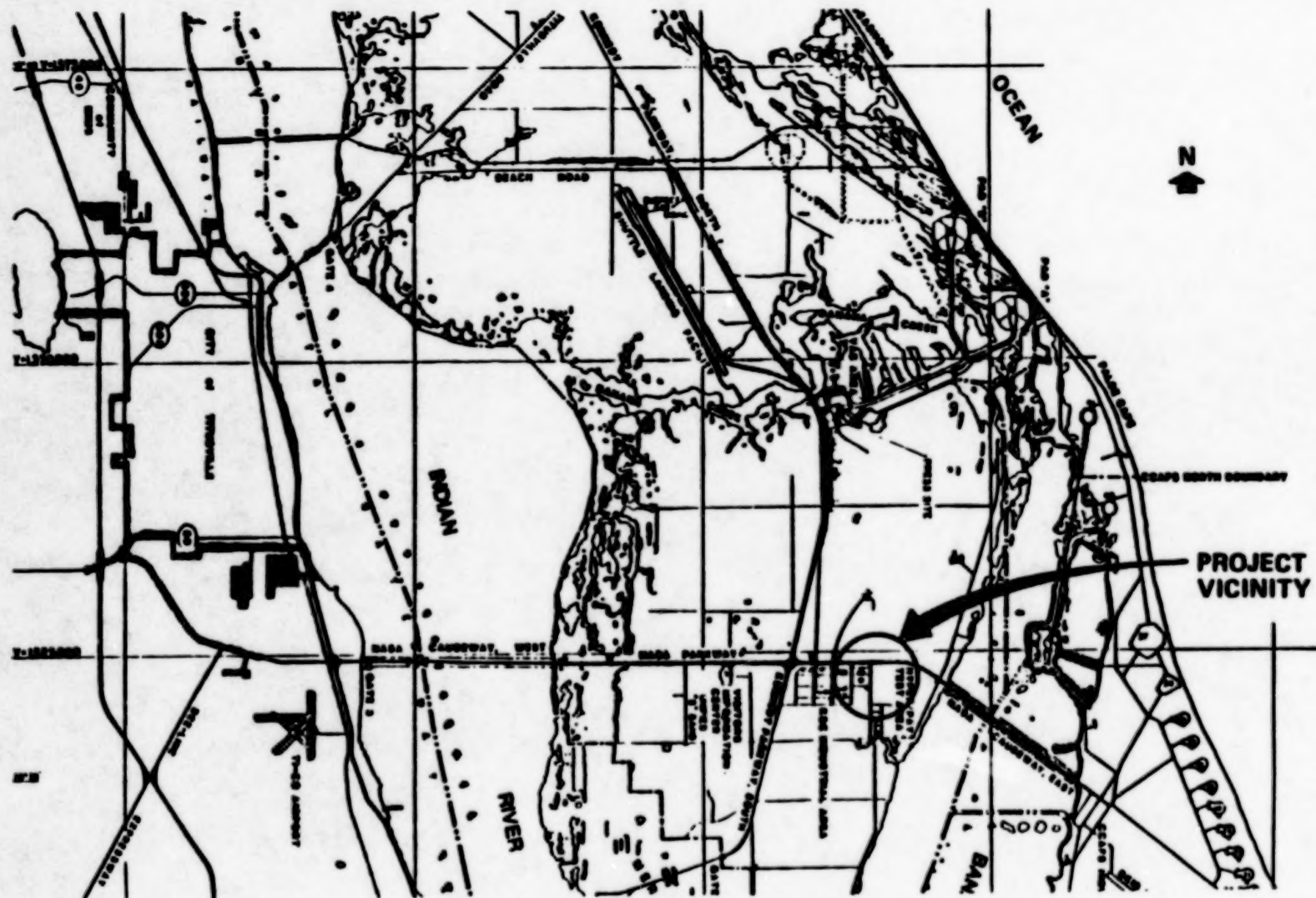


FIGURE 1

CF 1-10

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF SPACE STATION PROCESSING FACILITY

SITE PLAN
KSC INDUSTRIAL AREA

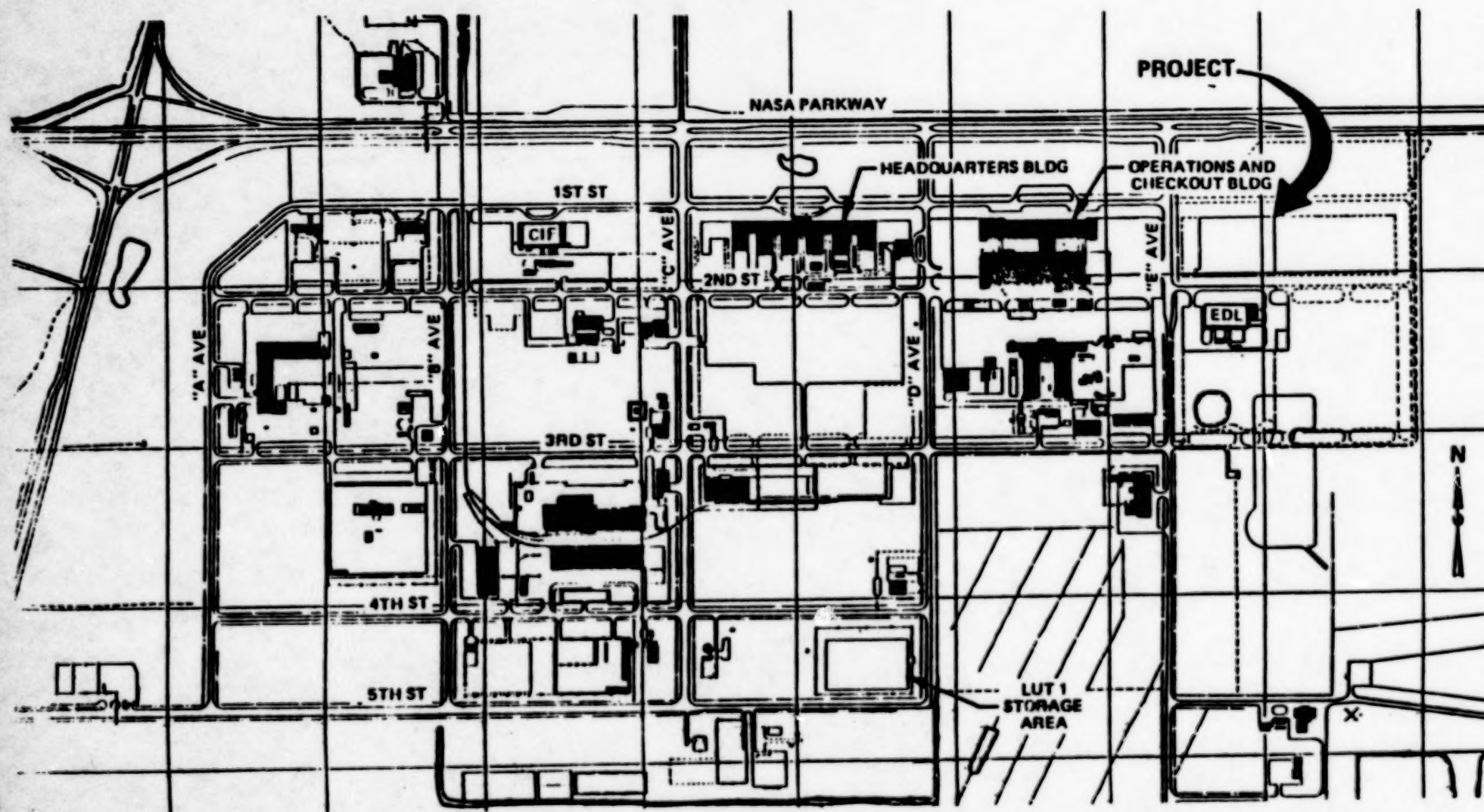


FIGURE 2

CF 1-11

**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF SPACE STATION PROCESSING FACILITY**

PERSPECTIVE

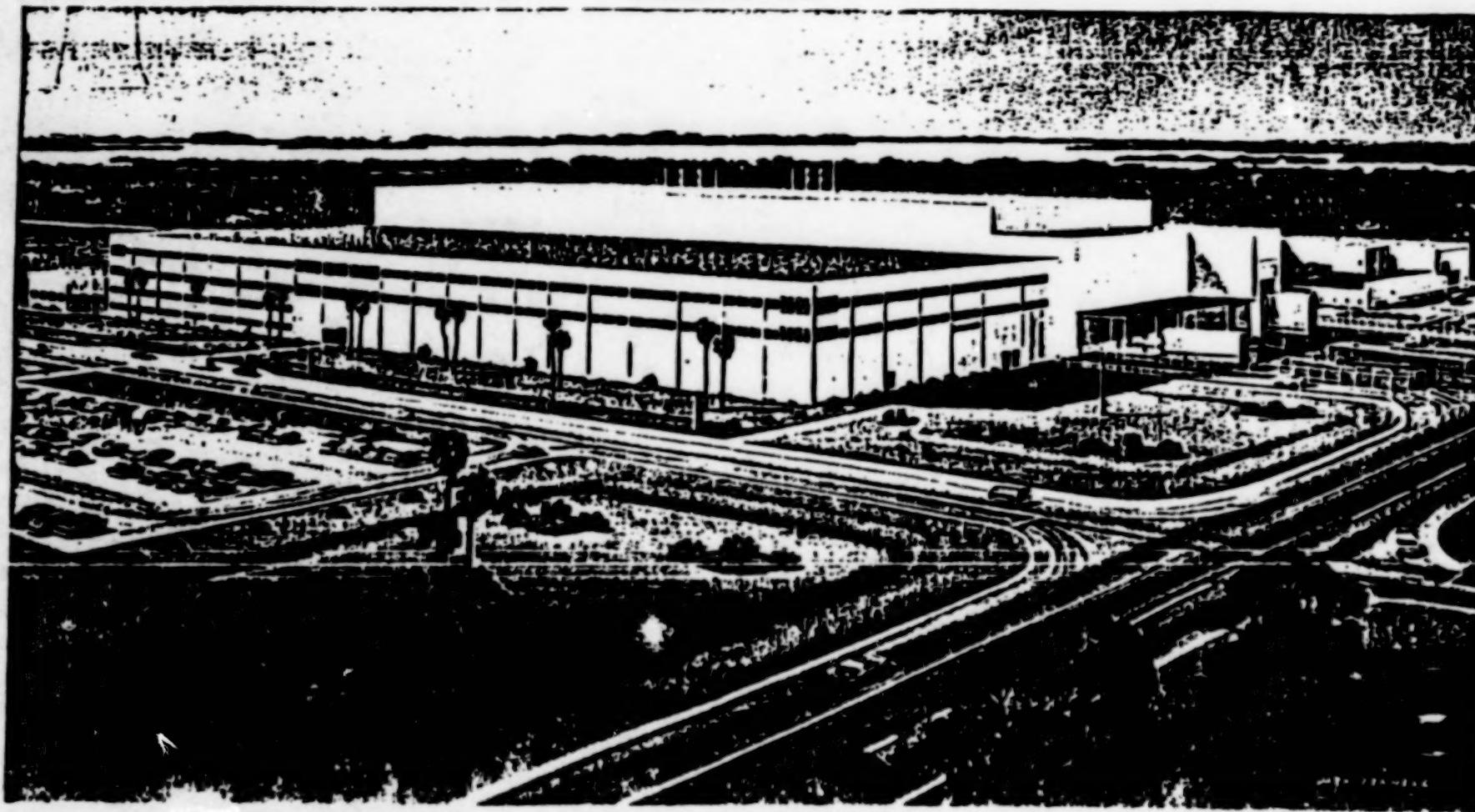


FIGURE 3

CF 1-12

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF SPACE STATION PROCESSING FACILITY

PLAN VIEW - FIRST FLOOR

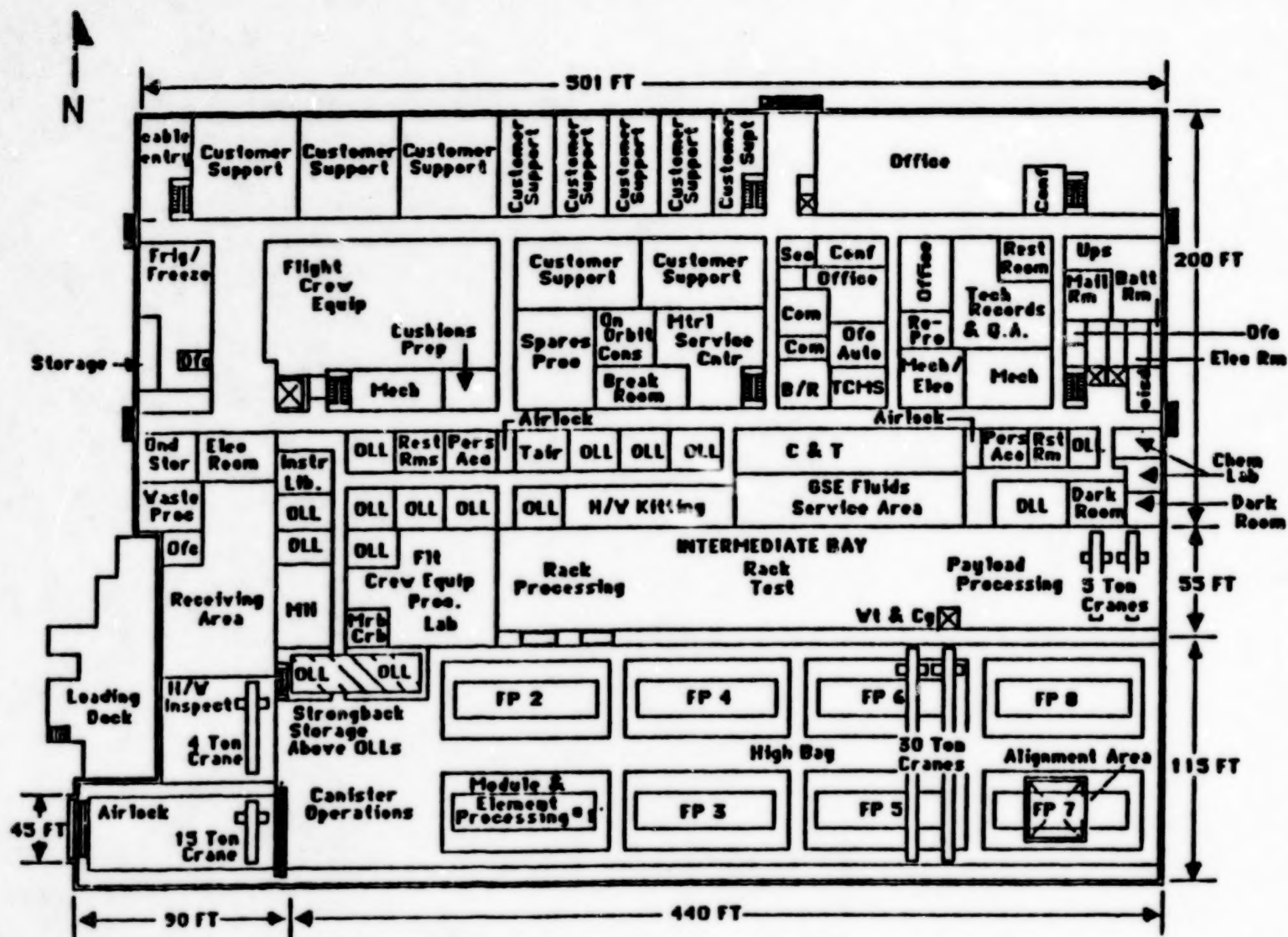


FIGURE 4

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF SPACE STATION PROCESSING FACILITY

PLAN VIEW - SECOND FLOOR

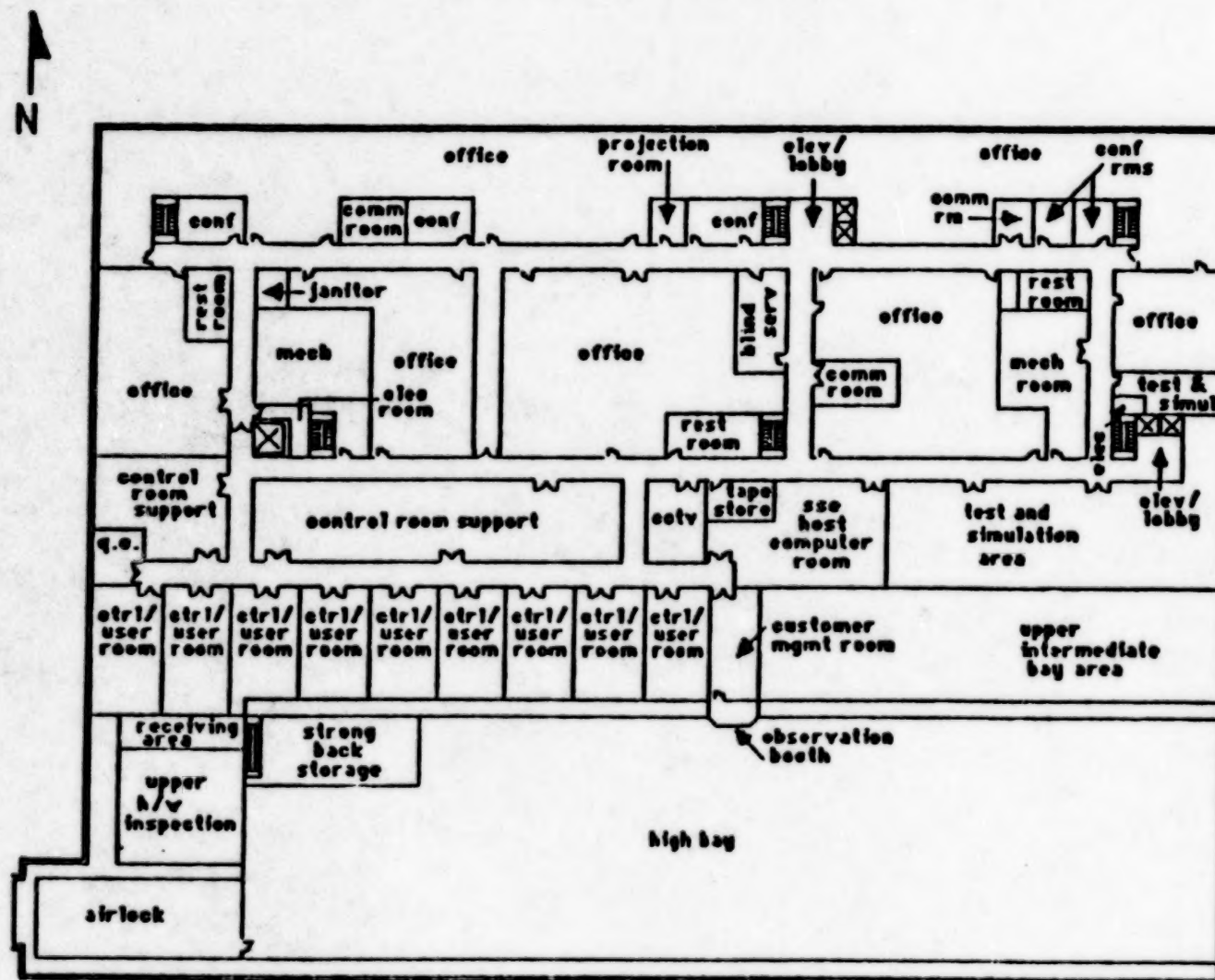


FIGURE 5

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF SPACE STATION PROCESSING FACILITY

PLAN VIEW - THIRD FLOOR

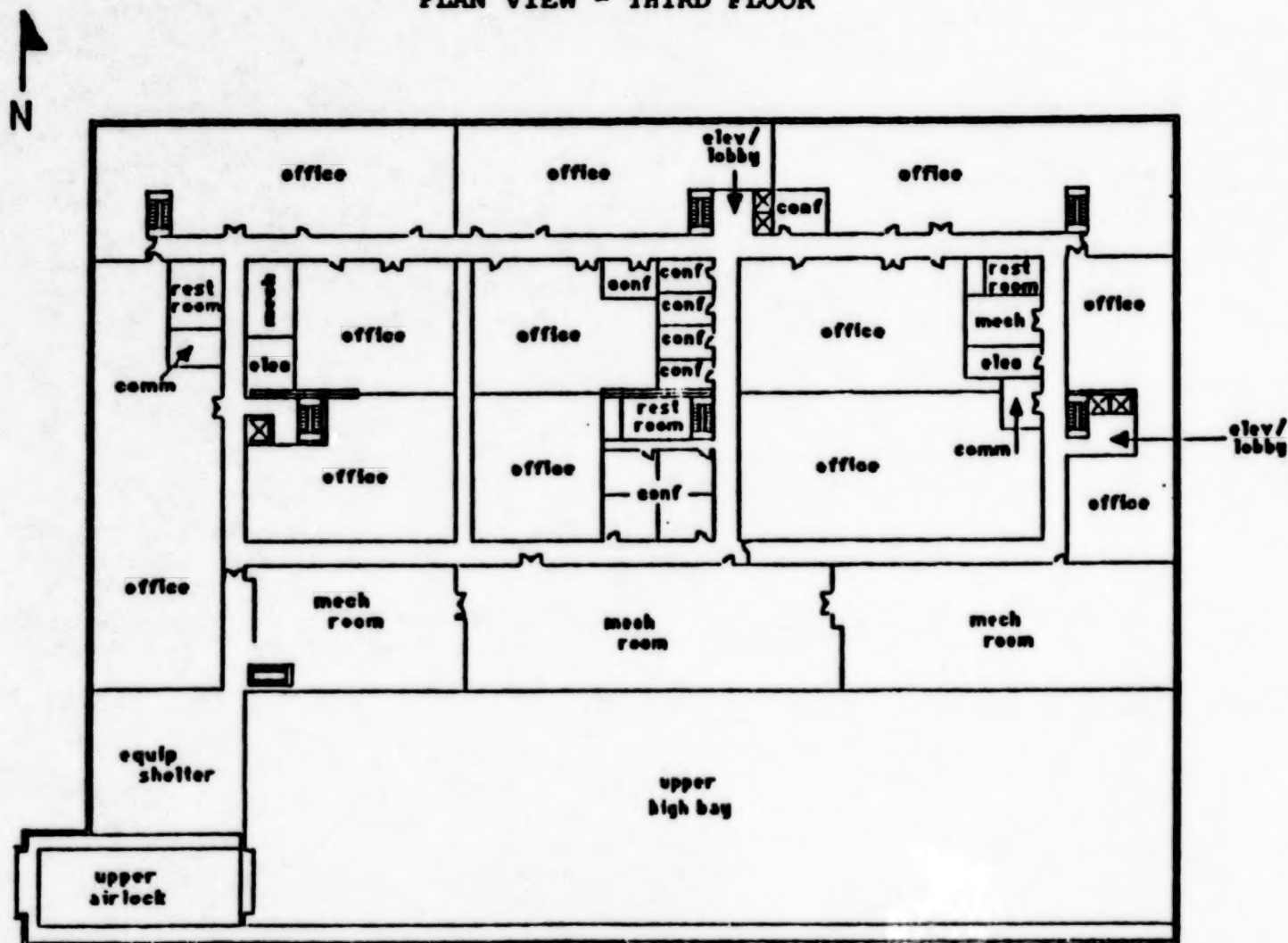


FIGURE 6

CF 1-15

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1991 ESTIMATES

SUMMARY

SPACE FLIGHT FACILITIES

Office of Space Flight: -----	Amount ----- (Dollars)	Page No. -----
Construction of Addition for Flight Training and Operations, Johnson Space Center.....	12,000,000	CF 2-1
Rehabilitation of Mission Control Center Power and Control Systems, Johnson Space Center.....	8,500,000	CF 2-6
Construction of Transporter/Canister Facility, Kennedy Space Center..	5,500,000	CF 2-12
Construct Processing Control Center, Kennedy Space Center.....	9,400,000	CF 2-19
Rehabilitation of Mission Control Center Power and Control Hypergolic Maintenance Facility, Kennedy Space Center.....	2,100,000	CF 2-26
Replace Operations and Checkout Building West Cooling Tower, Kennedy Space Center.....	1,000,000	CF 2-31
Restoration of Heavy Equipment Area, Kennedy Space Center.....	900,000	CF 2-37
Upgrade Orbiter Processing Facility High Bay Heating, Ventilating and Air-Conditioning System, Kennedy Space Center.....	3,300,000	CF 2-43
Upgrade Yundum International Airport to Full Transoceanic Abort Landing Site, Banjul, The Gambia, Kennedy Space Center.....	3,400,000	CF 2-49
Repair Condensate System, Main Manufacturing Building, Michoud Assembly Facility.....	900,000	CF 2-53
Construct Project Engineering Facility, Marshall Space Flight Center.	17,000,000	CF 2-58
Restoration of Information and Electronic Systems Laboratory, Marshall Space Flight Center.....	4,000,000	CF 2-63
Rehabilitation of Hydrogen Transfer Facility, Stennis Space Center...	2,700,000	CF 2-68
Restoration of Space Shuttle Main Engine Test Complex "A," Stennis Space Center.....	2,800,000	CF 2-73
Construction of Advanced Solid Rocket Motor Program Facilities (Various Locations).....	92,000,000	CF 2-78

Total.....	165,500,000 =====	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Construction of Addition for Flight Training and Operations

INSTALLATION: Lyndon B. Johnson Space Center

FY 1991 CoF Estimate: \$12,000,000

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project.

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF funding.....	\$1,814,292	---	\$1,814,292
Capitalized investment.....	---	<u>\$3,966,404</u>	<u>3,966,404</u>
Total.....	<u>\$1,814,292</u>	<u>\$3,966,404</u>	<u>\$5,780,696</u>

SUMMARY PURPOSE AND SCOPE:

This project provides the initial increment of construction for an addition to the existing Flight Operations Facility, Building 4, to meet the combined Space Transportation System (STS) and Space Station operations era requirements for space flight crew training. This four story addition, of approximately 148,000 square feet, will provide required facility space for offices and related multipurpose mission support areas, computer-aided training rooms and systems trainers, automated mission and crew procedures, planning, and data preparation and reconfiguration, electronically enhanced training/conference rooms, and additional astronaut support, such as, a technical library, a mailroom, and secure storage. Included in this increment are the installation of utilities and utility tunnel tie-ins, power wiring, rough grading, drainage and basic structure layout and building envelope.

CF 2-1

PROJECT JUSTIFICATION:

This project is required to provide integrated office and training space for the increased personnel and systems needed for space flight crew members, training, systems, and flight control support within the Johnson Space Center (JSC) crew training area complex. Conservative estimates indicate that additional staffing of 750 people will require workspace in the crew training complex by 1994 and the existing facilities are already overcrowded resulting in inefficient separation and distribution of personnel and functional groups. The new facility must accommodate the anticipated growth through the 1990's as well as continue to support existing personnel and activities. There are no other facilities at or adjacent to JSC that can provide such space for flight crew training.

IMPACT OF DELAY:

If this project is not approved, space flight crew training and mission preparation and support will be severely impacted during a period of major staff increases. Additional facility space of this type and purpose is urgently needed and a 1991 construction start is critical for meeting the major staff buildup required in preparation for Space Station operations.

PROJECT DESCRIPTION:

This project provides site work, utilities, foundations, structural steel and the primary enclosure for the construction of a four-story addition sited just to the south of the existing Flight Operations Facility, Building 4. The addition will be comprised of approximately 148,000 square feet of total floor space and will be connected to each of the three floors of Building 4 by an enclosed passageway. The addition will provide approximately 111,000 square feet of usable office, training areas, automatic data processing laboratory, and technical support space for flight crews, flight control, and flight support personnel and their integrated training and information systems. Raised flooring will be installed as required. The new facility also will include support service areas, restrooms, service and passenger elevators, a utility tunnel extension and connections to site utilities, fire detection and suppression systems, and connections to the site utility control system. All basic work as well as selected long lead items will be accomplished as part of this initial increment. The small parking lot south of Building 4 will be demolished and existing paved service drives will be reconfigured as required. Pedestrian walkways, a loading dock, and paved parking for approximately 500 vehicles will be included in the follow-on increment.

PROJECT COST ESTIMATE: Based on criteria and concepts only.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$12,000,000</u>
<u>Site Preparation:</u>				
Demolition and Landscaping.....	LS	---	---	40,000
Utilities and Utility Tunnel.....	LS	---	---	1,000,000
<u>Modifications to Existing Building:</u>	LS	---	---	100,000
<u>New Addition:</u>				
Architectural/Structural.....	LS	---	---	7,510,000
Heating, Ventilating, and Air- Conditioning System.....	LS	---	---	1,250,000
Plumbing.....	LS	---	---	500,000
Sprinkler.....	LS	---	---	200,000
Electrical Power, Lighting, and Grounding.....	LS	---	---	1,200,000
Fire Detection and Telephone Systems.....	LS	---	---	<u>200,000</u>
 Total.....				 <u>\$12,000,000</u>

Note: This cost estimate provides for the initial increment of construction. The total estimated cost is \$24,300,000.

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan Figure 2 - Perspective

OTHER EQUIPMENT SUMMARY:

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Approximately \$12,300,000 will be required in FY 1992 to complete this project.

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF ADDITION FOR FLIGHT
TRAINING AND OPERATIONS

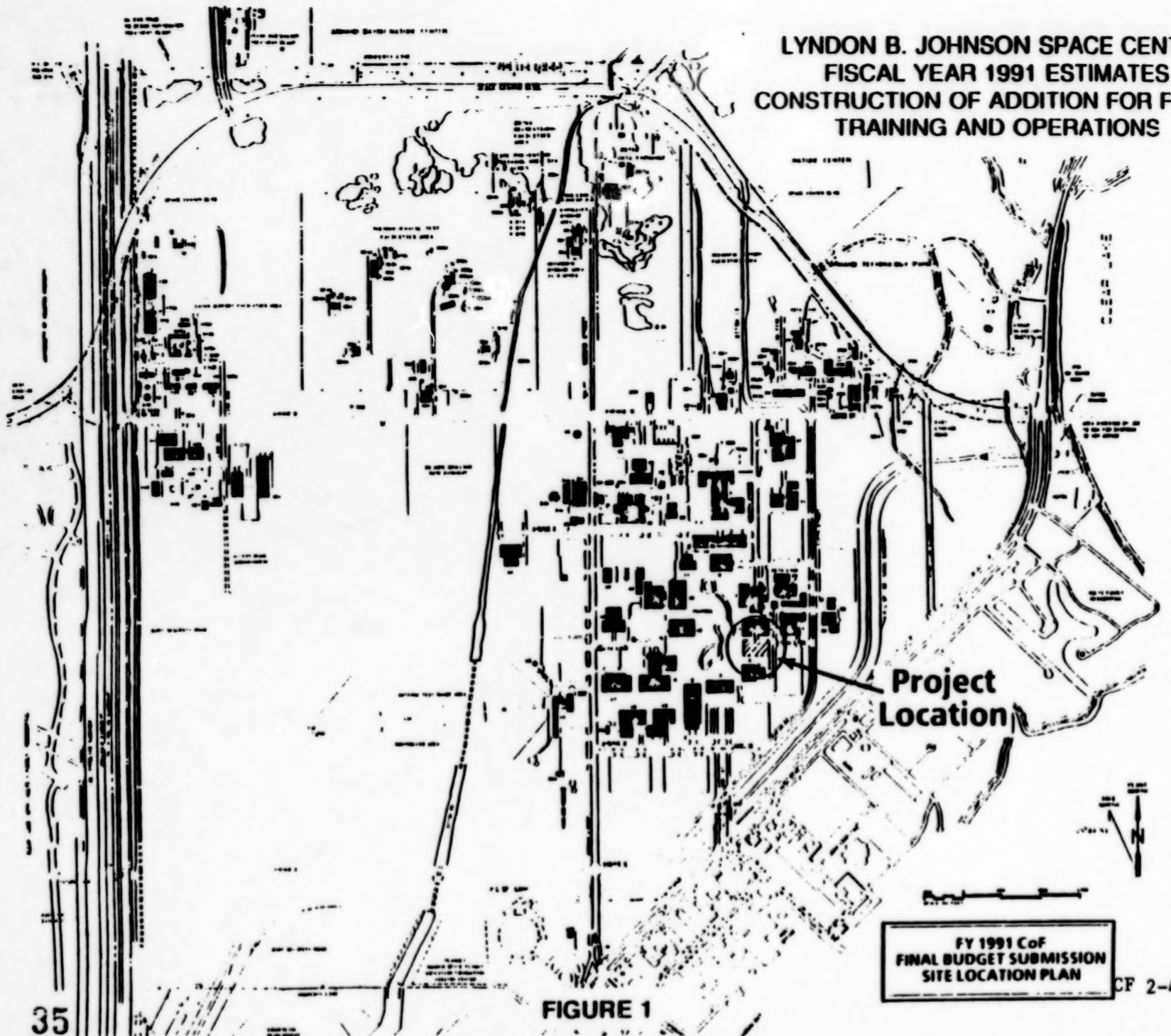
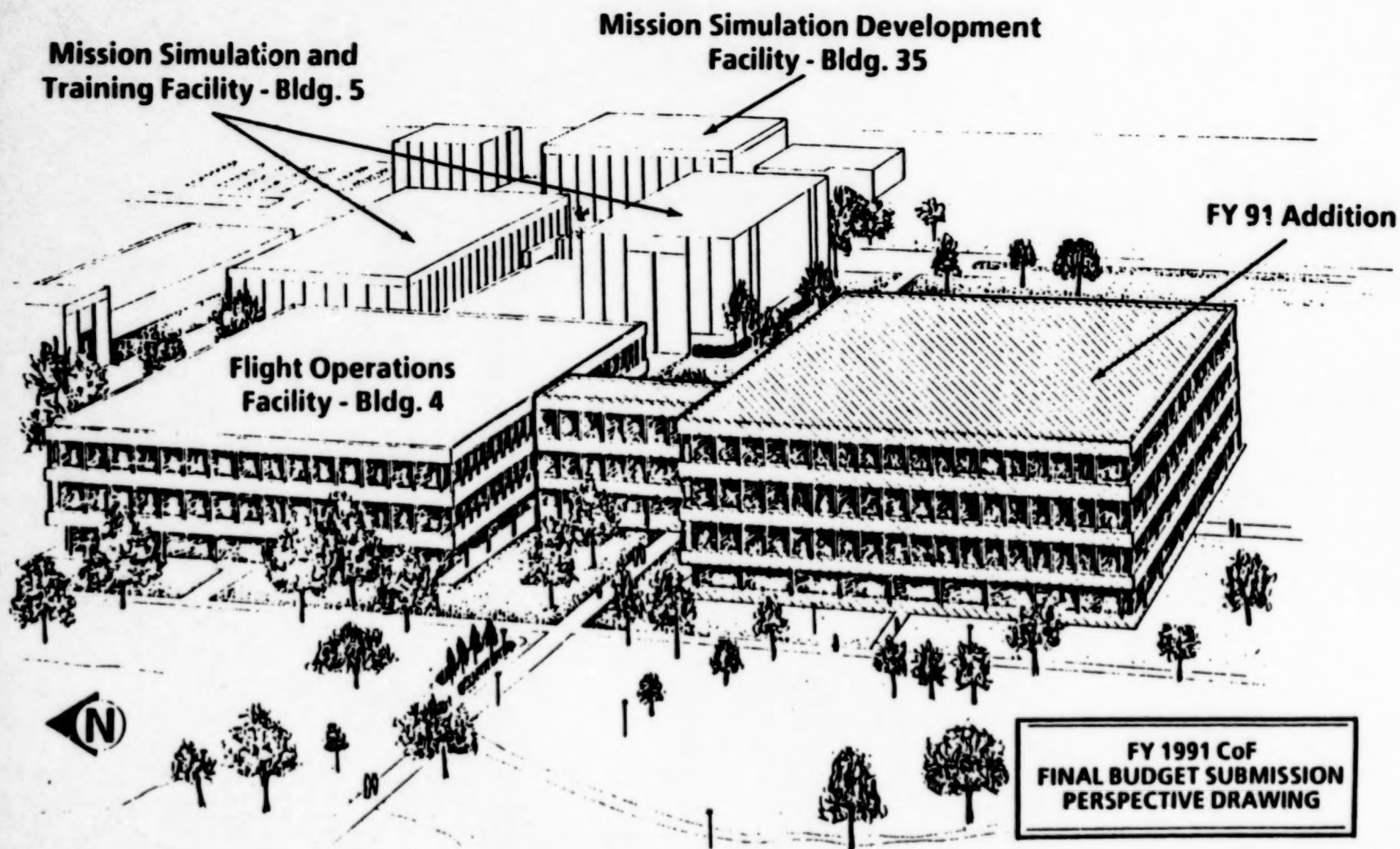


FIGURE 1

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF ADDITION FOR FLIGHT TRAINING AND OPERATIONS



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Rehabilitation of Mission Control Center Power and Control System

INSTALLATION: Lyndon B. Johnson Space Center

FY 1991 CoF Estimate: \$8,500,000

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project.

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF funding.....	\$627,500	---	\$ 627,500
Capitalized investment.....	---	\$15,229,719	15,229,719
Total.....	<u>\$627,500</u>	<u>\$15,229,719</u>	<u>\$15,857,219</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for rehabilitation of the power and control systems in the Mission Control Center (MCC) complex to reduce overloading of the critical electrical buses and provides additional critical power to support planned equipment modifications. In addition, this work includes replacement of the antiquated diesel engine control systems with a new micro processor based system with system diagnostic capability. Construction of a secure passageway to provide an alternate path for power cables and chilled water piping is also included.

PROJECT JUSTIFICATION:

Load studies and tests indicate that the critical power buses, "A" and "B", that supply the MCC are fully loaded and in some operating modes are overloaded. Planned equipment modifications to increase critical power requirements are: the addition of Payload Support Rooms; Mission Control Center Distribution 2.3 Integrator Workstation Hardware; Digital Integrator Visual Systems; Orbital Maneuvering Vehicle; Communications Security (CONSEC) Equipment Facility.; Multiplexer/Demultiplexer Facility; Meteorological Interactive Data Display; System S; System X; Computerized Output Microfilm; Software Production Facility, and Mission Evaluation Room. In addition, this project provides for increasing the reliability, efficiency, and safety of the utilities that are generated and distributed from the Emergency Power Building in support of the MCC. Construction of a secure passageway is required to provide an alternate route for power cables and chilled water piping. Presently, all the utilities are routed via the existing tunnel system. A major fire in this area would result in a total loss of support utilities to the MCC.

The existing equipment control panels have exceeded their life expectancy, are not expandable to handle new equipment, and contain parts that are no longer manufactured. Critical replacement parts, substituted or fabricated, do not always provide an acceptable level of function or reliability. A new micro processor based distributed control system with graphic displays of equipment and operating configurations will provide needed selective alarm and response capability necessary to operate this critical facility.

IMPACT OF DELAY:

If this project is not approved, there will be a continuous risk of power failure from overloading, and operational restrictions will be required for many of the planned equipment modifications in support of the Space Transportation System. In addition, all support systems are routed through a single point failure which could result in total loss of utilities to the MCC.

PROJECT DESCRIPTION:

The project includes construction of a 4,312-square-foot addition to Building 48; construction of a secure passageway between the MCC and Building 48; and installation of a 2,848-kilowatt (kW) diesel generator, a two-cell ceramic cooling tower, and a 10,000 gallon diesel fuel tank. Manual controls for the diesel engines and switchgear will be replaced with a micro processor based control system. A computer grounding system and power distribution units will be installed in the MCC. Additionally, this project includes upgrading two motor-control centers from 600 amperes to 800 amperes; replacement of the critical 4,000 ampere, 480-volt B-Power Switchgear; replacement of a 700 ton chiller with a 1,000 ton chiller, installation of chilled water pumps and piping; relocation of existing control equipment inside the control room; and installation of process controllers on chillers 3 and 4. New heating, ventilating, and air-conditioning also will be installed in the MCC.

CF 2-7

PROJECT COST ESTIMATE: Based on a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$8,500,000</u>
4,312-square-foot Addition to Building 48.....	SF	4,312	\$ 88.82	\$383,000
Air-handlers, Ducts, Variable Mixing Boxes, etc...	EA	3	346,333.00	1,039,000
B-Power Switchgear.....	LS	---	---	1,540,000
Install Diesel Generator.....	EA	1	---	693,000
Ceramic Cooling Tower.....	EA	1	---	693,000
Other Modifications and Equipment.....	---	---	---	<u>4,152,000</u>
Total.....				<u>\$8,500,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Perspective Figure 3 - Cutaway Drawing

OTHER EQUIPMENT SUMMARY: None

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

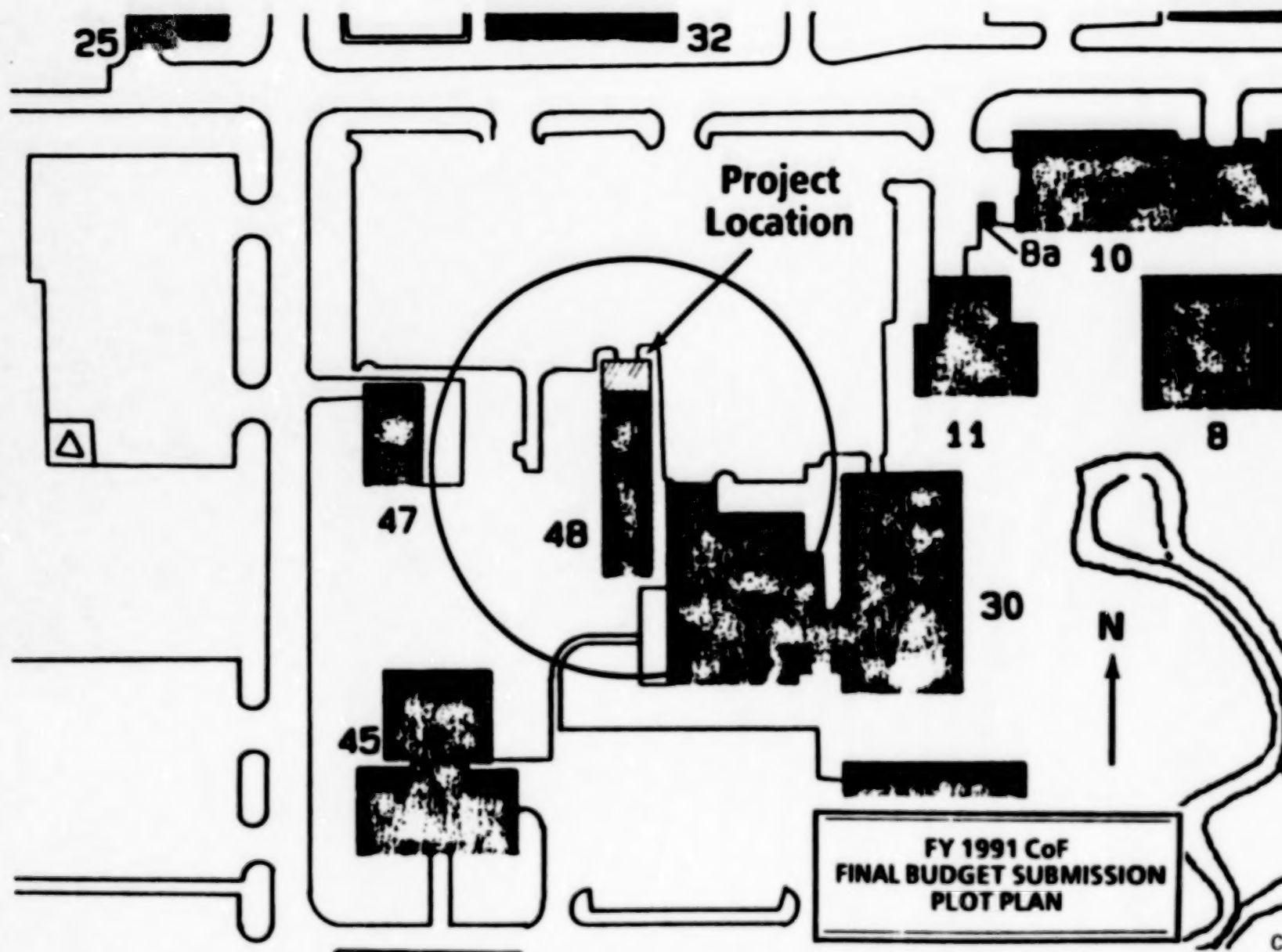
LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
REHABILITATION OF MISSION CONTROL
CENTER POWER AND CONTROL SYSTEM

Project
Location

FY 1991 CoF
FINAL BUDGET SUBMISSION
SITE LOCATION PLAN

FIGURE 1

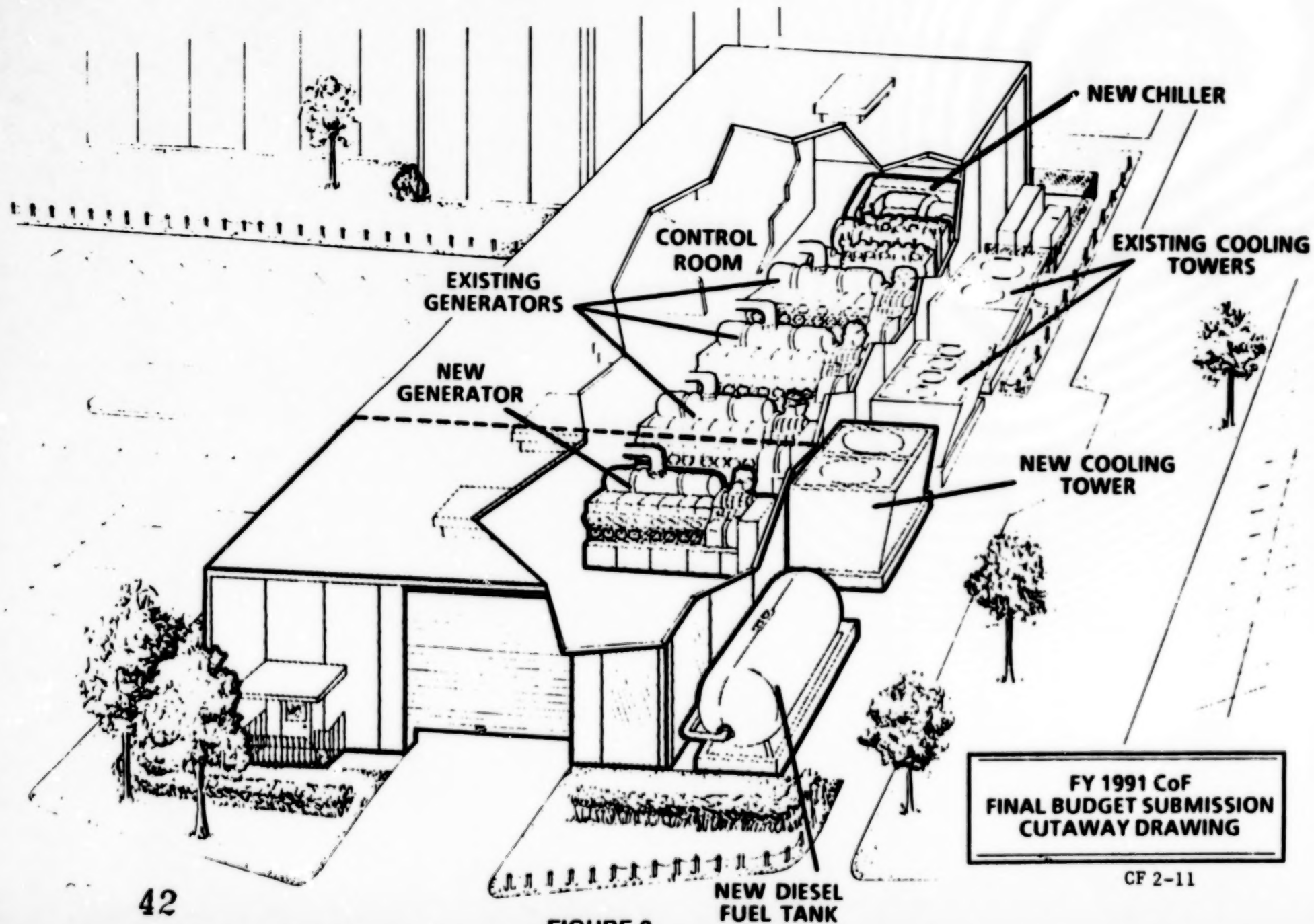
LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
REHABILITATION OF MISSION CONTROL CENTER POWER AND CONTROL SYSTEM



CF 2-10

FIGURE 2

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
REHABILITATION OF MISSION CONTROL CENTER POWER AND CONTROL SYSTEM



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Construct Transporter/Canister Facility

INSTALLATION: John F. Kennedy Space Center

FY 1991 CoF Estimate: \$5,500,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$405,000	---	\$405,000
Capitalized Investment.....	---	---	---
Total.....	<u>\$405,000</u>	<u>---</u>	<u>\$405,000</u>

SUMMARY PURPOSE AND SCOPE:

This project will provide approximately 7,600 square feet of high bay facility for reconfiguration and maintenance of the Space Shuttle payload canister in the vertical position. This project is necessary to provide a clean and controlled environment for the canister to protect sensitive payloads from contamination and avoid adverse impacts to flight rates. This facility will be constructed adjacent to an existing low bay facility (Figure 2) where horizontal canister operations are performed in support of Space Shuttle operations.

PROJECT JUSTIFICATION:

The facility will accommodate the requirements for storage and maintenance functions which are necessary to keep the transporter/canister system operational. It will also provide the capability to rotate the payload canister, reconfigure the payload support fittings and other payload interfaces for each mission. In addition, lifting equipment for payload canister rotation can be stored in a fully rigged configuration. At present, it takes several hours to assemble the lifting equipment and several more hours to disassemble and store it.

Payload processing experience has shown that cleaning the canister in the vertical position reduces the surface areas requiring cleaning due to the canister being more susceptible to contamination when it is in the horizontal position. This operation is more efficient and less time consuming and is now the standard procedure. Rotation of the canister, which is required for nearly all missions, is currently performed in the Vehicle Assembly Building (VAB) transfer aisle. Due to hazardous operations involving the stacking of the solid rocket motors and integration of the orbiter with the external tank and the solid rocket booster in the VAB, rotation of the canister frequently has to be delayed causing use of premium time personnel hours to maintain the Transporter/Canister schedule to support the STS program. The VAB crane utilization for stacking Solid Rocket Motors (SRM), External Tank (ET) and Orbiter restricts the crane availability for canister operations and subsequently will impact increasing flight rates.

IMPACT OF DELAY:

Delay in the construction of this facility will adversely impact payload equipment and operations required to support the Space Shuttle Program in a timely and efficient manner.

PROJECT DESCRIPTION:

This project provides for construction of an approximately 7,600-square-foot area, 112 foot high bay facility adjacent to the existing low bay facility (Figures 3 and 4). Included is a small office area adjacent to the high bay. The planned height of the high bay is sufficient to provide access by the transporter when moving the canister in the vertical position and includes two 100-ton overhead cranes for canister rotation. The facility must be environmentally controlled to prevent contamination of the canister bay when the canister doors are in the open position.

PROJECT COST ESTIMATE: Based on the KSC Construction Cost Index and a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$5,500,000</u>
Site Preparation.....	LS	---	---	312,000
Arch/Structural.....	CF	672,000	\$ 2.93	1,967,000
Mechanical.....	SF	6,000	56.00	336,000
Electrical.....	SF	6,000	36.17	217,000
Rollup Doors.....	SF	1,924	115.90	223,000
100-Ton Bridge Crane.....	EA	2	1,124,000	2,248,000
Office Area.....	SF	1,600	123.17	197,000
Total.....				<u>\$5,500,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Figure 2 - Site Plan Figure 3 - Perspective Figure 4 - Plan View

OTHER EQUIPMENT SUMMARY:

Non-collateral equipment to be funded from R&D resources.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCT TRANSPORTER / CANISTER FACILITY**

**LOCATION PLAN
JOHN F. KENNEDY SPACE CENTER, FLORIDA**



FIGURE 1

CF 2-15

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCT TRANSPORTER / CANISTER FACILITY

SITE PLAN
KSC INDUSTRIAL AREA

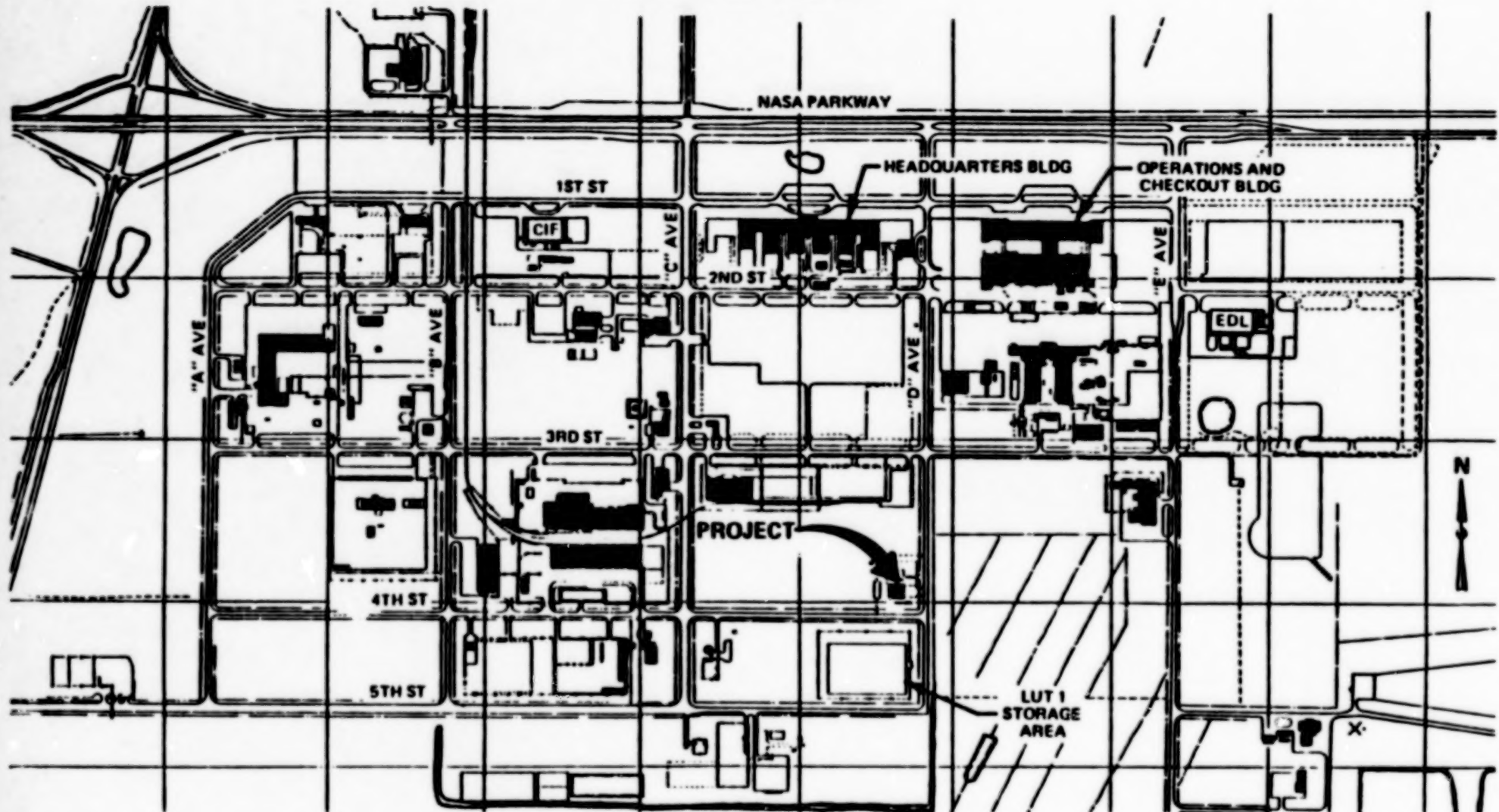


FIGURE 2

CF 2-16

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**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCT TRANSPORTER/CANISTER FACILITY
PERSPECTIVE**

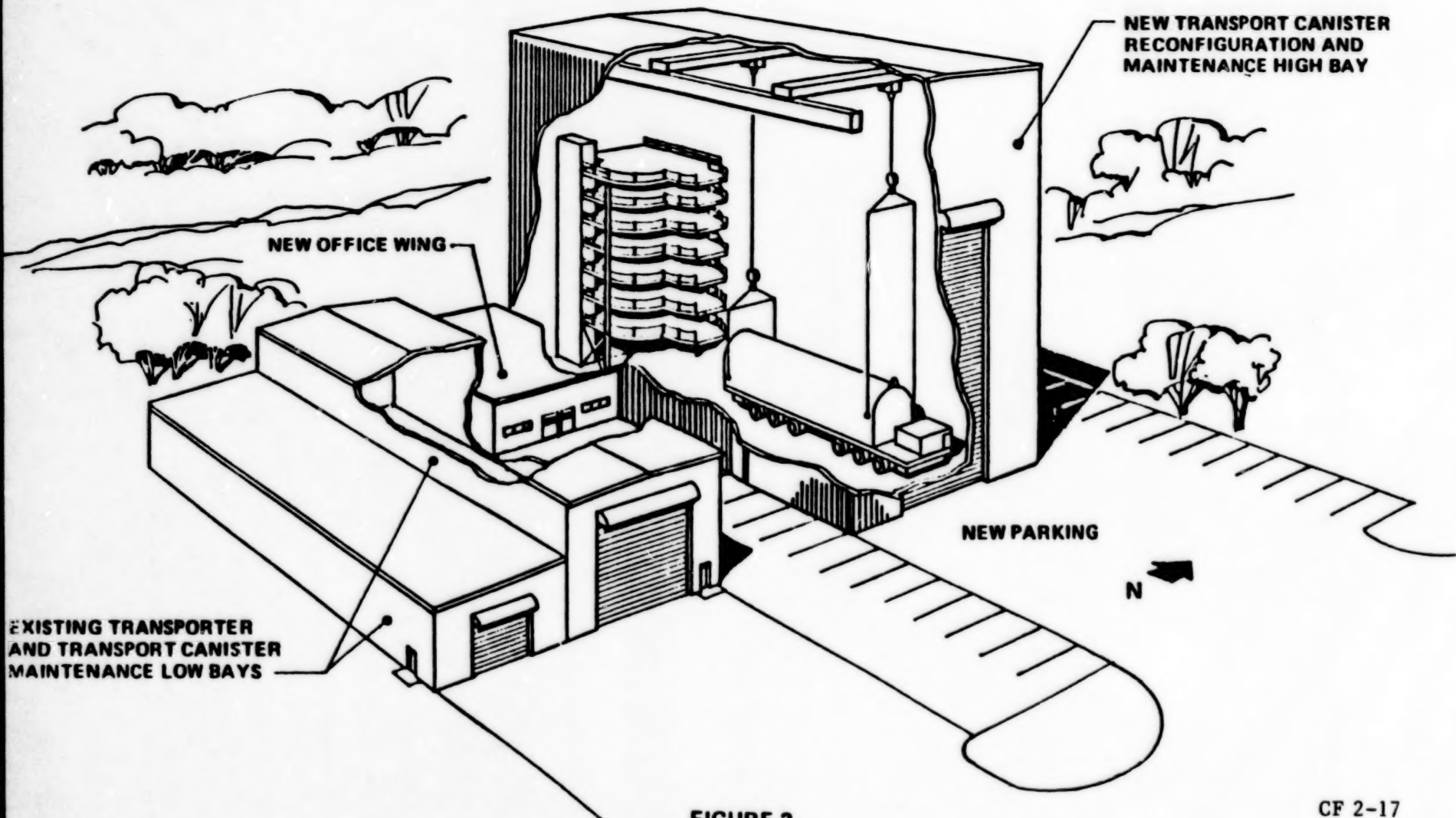


FIGURE 3

CF 2-17

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCT TRANSPORTER/CANISTER FACILITY

PLAN VIEW

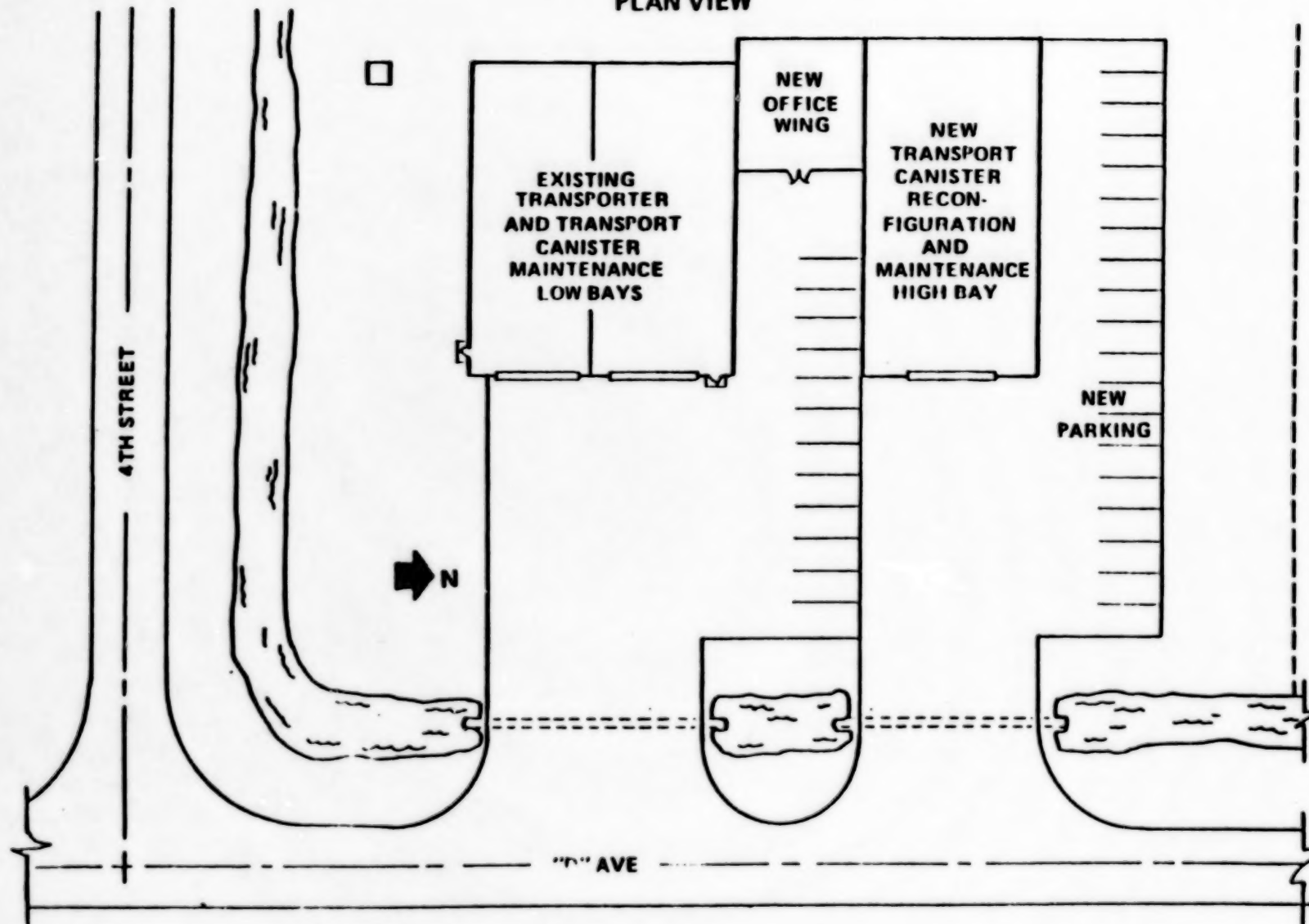


FIGURE 4

CF 2-18

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Construct Processing Control Center

INSTALLATION: John F. Kennedy Space Center

FY 1991 CoF Estimate: \$9,400,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project.

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF funding.....	\$902,000	---	\$902,000
Capitalized investment.....	---	---	---
Total.....	<u>\$902,000</u>	<u>---</u>	<u>\$902,000</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of an approximately 66,000-square-foot "stand alone" control center facility to support checkout of Space Shuttle orbiters being processed through the Orbiter Processing Facility (OPF) highbays and for performance of intermediate level maintenance for the Launch Processing System (LPS).

CF 2-19

PROJECT JUSTIFICATION:

This facility will accommodate a new checkout, control and monitoring system (CCMS II) to support more effective and efficient launch processing. This improved system is needed to support the increased launch programs in the 1990's, and the four-orbiter fleet. Meeting these increased program requirements involves maximized utilization of the Vertical Assembly Building, three OPF's, two launch pads, and Launch Control Center (LCC); checkout and test of flight vehicle systems for parallel and multiflow processing of the four-orbiter fleet; software development, launch team training, and troubleshooting of real-time flight hardware problems. This can only be accomplished with the CCMS II which is more responsive to the complex processing operations driven by lengthy OPF stay times. The existing CCMS is 15 years old, performance limited and failure prone.

Since OPF testing is limited to a small number of subsystems tests at a time, use of this facility capability will eliminate having to bring up a total LCC firing room for subsystem tests. This facility will also provide the capability to transition to CCMS II while still maintaining CCMS I capability. This latter capability avoids the need to construct an additional firing room for transitioning to CCMS II.

In addition, a facility is required in the Launch Complex 39 (LC-39) area to provide line replacement unit (parts/systems) repair for both existing and future LPS sets of equipment including CCMS II and Shuttle related ground and flight systems. LPS maintenance has been performed in the Central Instrumentation Facility since the beginning of the Shuttle program. During this time maintenance and test requirements have increased with little or no increase in the off-line maintenance facility. A larger facility in the LC-39 area will result in improved responsiveness due to its proximity to the LCC (Figure 2).

IMPACT OF DELAY:

Deferral of this project would require high cost alternatives involving emergency construction of another LCC Firing Room, reduction in flight rate, and expensive, prolonged installation/phase-in of the CCMS II equipment.

PROJECT DESCRIPTION:

This project provides for construction of a 66,000-square-foot, three story pre-cast concrete building (Figure 3) to house control rooms, offices, and maintenance space in support of OPF/Orbiter testing and LPS maintenance. The third floor of the facility will be configured to house three control rooms in support of three OPF highbays (Figure 4.). Each control room will be equipped with raised flooring, air conditioning, communications, power, etc., to support new CCMS equipment. A communications duct bank will be constructed to interface checkout equipment with the OPF highbays. The second floor of the facility will provide office

CF 2-20

space for engineering and technical personnel supporting Orbiter testing. The first floor will provide shop, laboratory space for maintenance and testing of LPS equipment.

PROJECT COST ESTIMATE:

Based on a completed Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$9,400,000</u>
Site Work.....	LS	---	---	368,000
Arch/Structural.....	SF	65,895	\$62.75	4,135,000
Mechanical.....	SF	65,895	39.80	2,623,000
Electrical.....	SF	65,895	34.50	2,274,000
Total.....				<u>\$9,400,000</u>

LIST OF RELATED GRAPHICS:

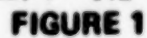
Figure 1 - Location Plan Figure 2 - Site Plan Figure 3 - Perspective Figure 4 - Third Floor Plan

OTHER EQUIPMENT SUMMARY:

CCMS II equipment estimated to cost approximately \$28,000,000 is being funded from Space Flight, Control and Data Communications.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None.

LOCATION PLAN
JOHN F. KENNEDY SPACE CENTER, FLORIDA



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**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCT PROCESSING CONTROL CENTER**

**SITE PLAN
VAB AREA**

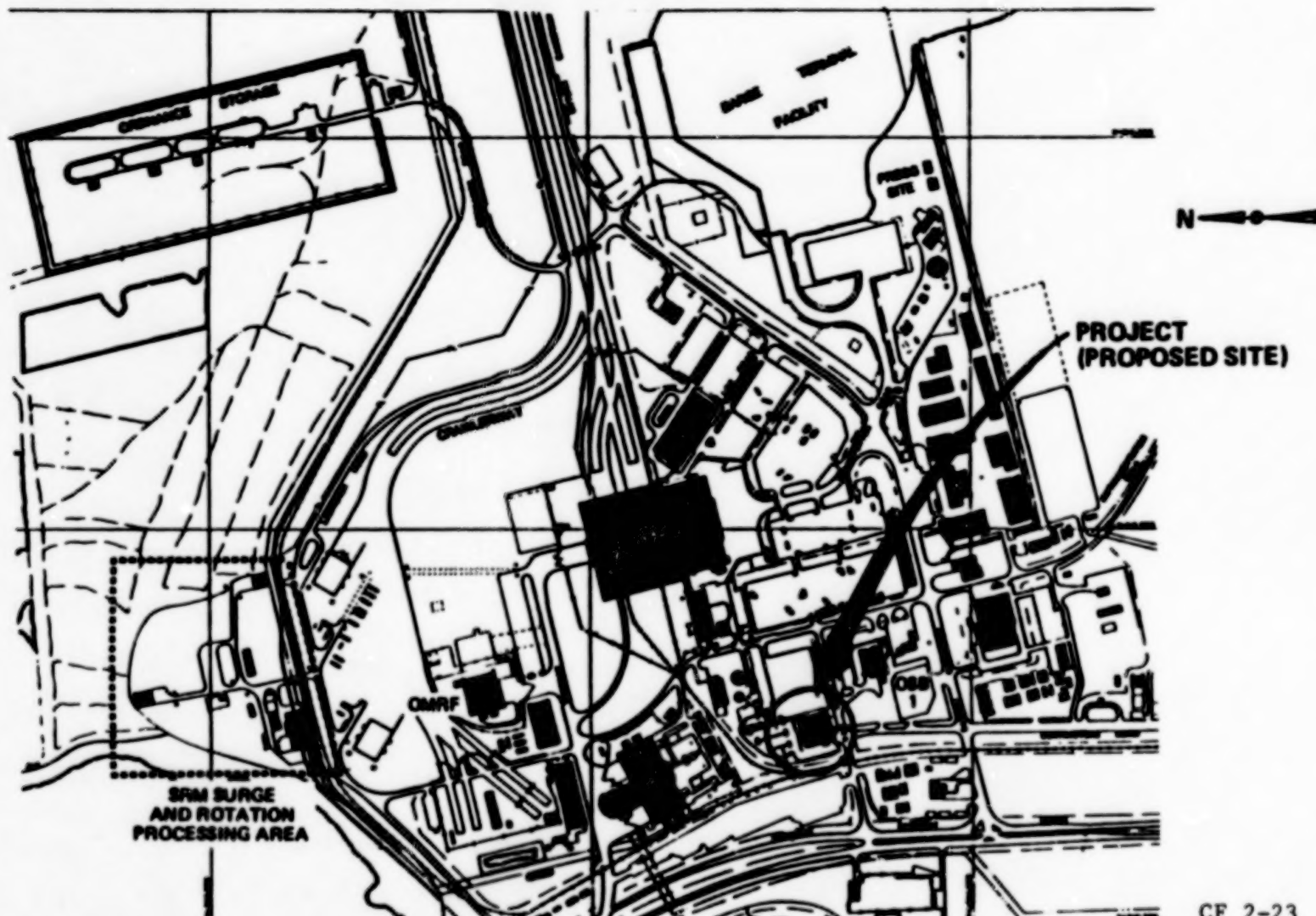
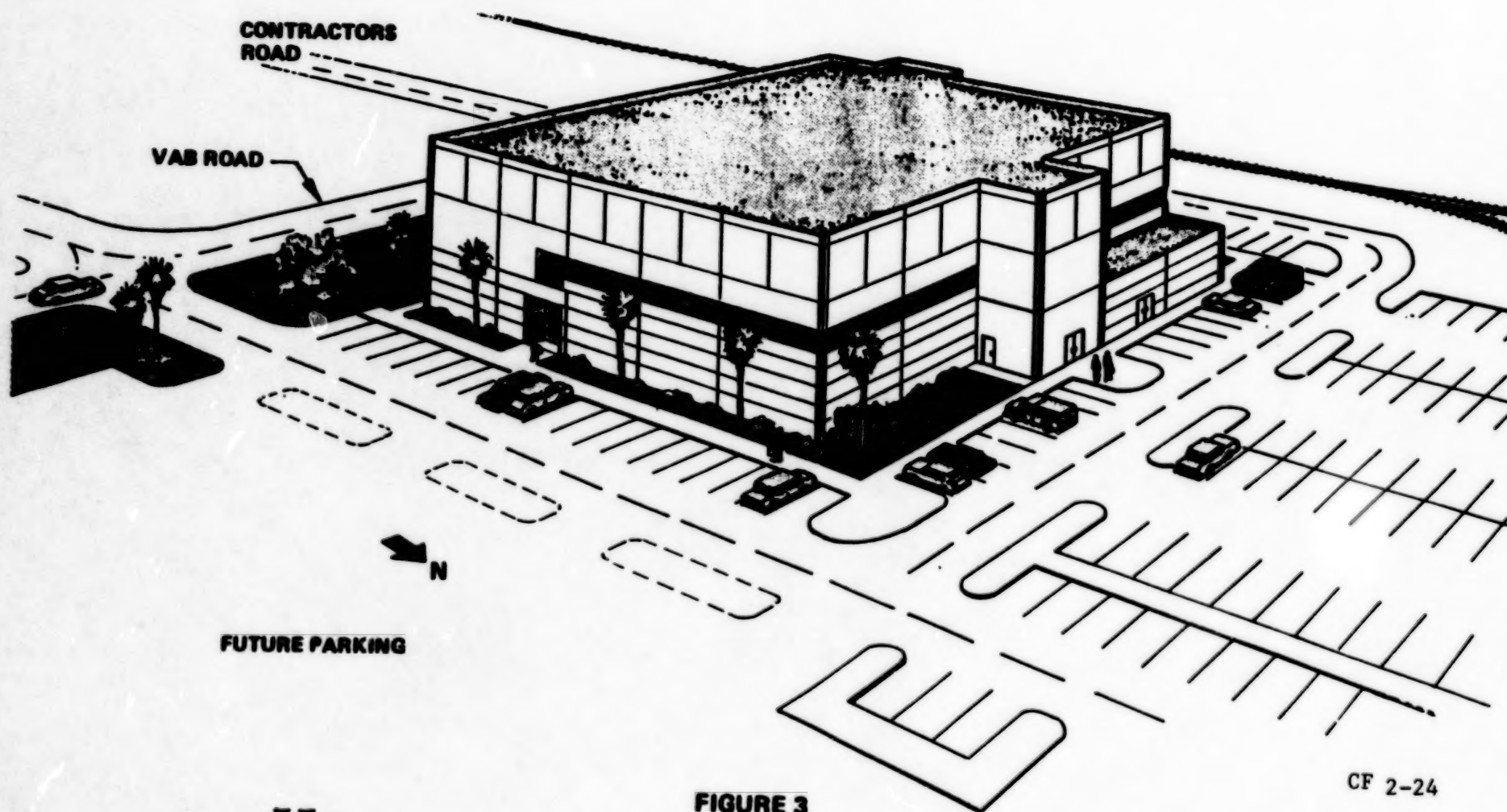


FIGURE 2

CF 2-23

**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCT PROCESSING CONTROL CENTER**

PERSPECTIVE



**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCT PROCESSING CONTROL CENTER**

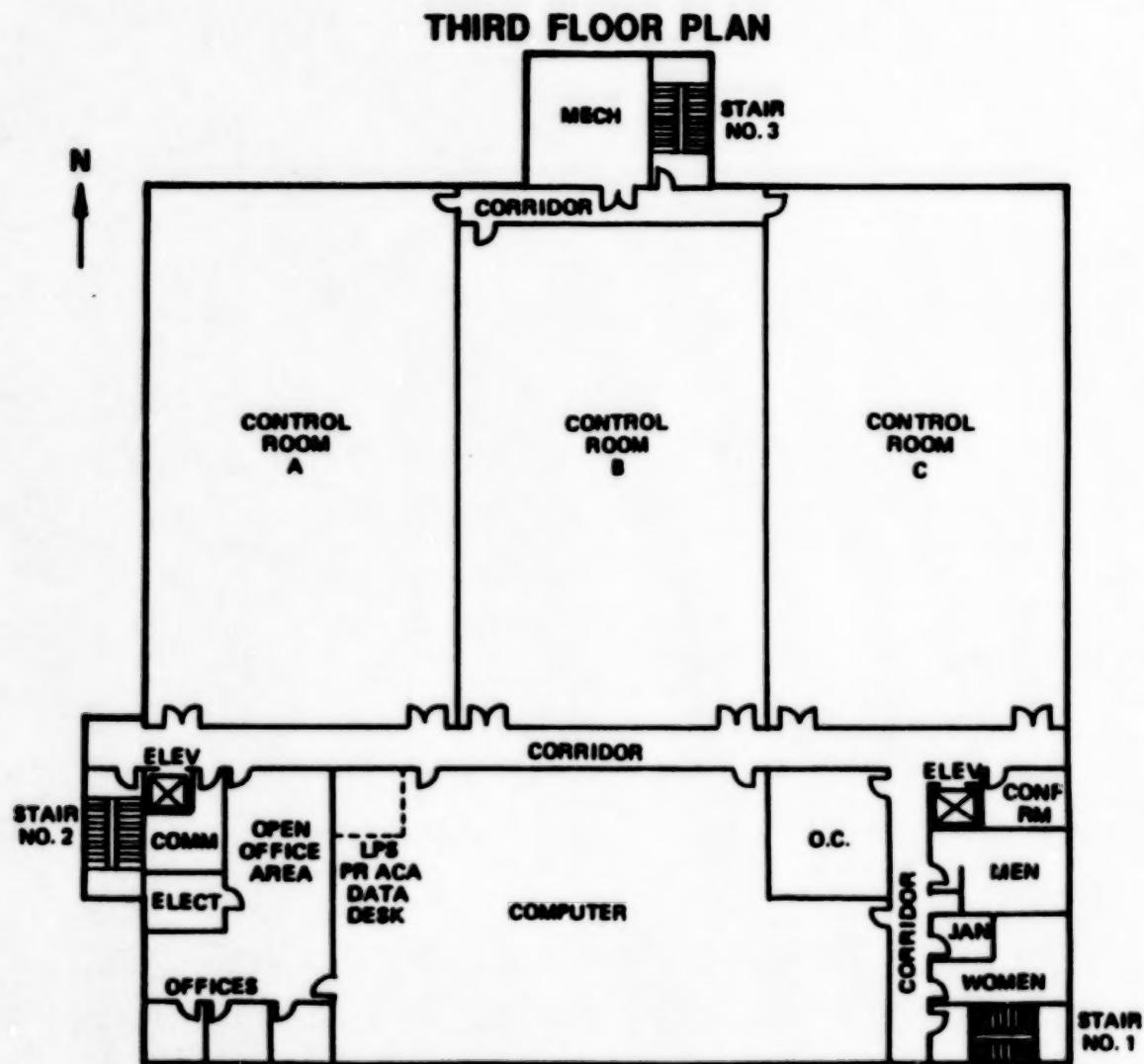


FIGURE 4

CF 2-25

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Replace Heating, Ventilating and Air-Conditioning System, Hypergolic Maintenance Facility

INSTALLATION: John F. Kennedy Space Center

FY 1991 CoF Estimate: \$2,100,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$210,000	---	\$ 210,000
Capitalized Investment.....	---	<u>\$9,172,182</u>	<u>9,172,182</u>
Total.....	<u>\$210,000</u>	<u>\$9,172,182</u>	<u>\$9,382,182</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for replacement of air handlers, condensers, pumps, chillers, and controls at Hypergolic Maintenance Facility (HMF) Buildings M7-961, M7-1061, and M7-1212 to provide more reliable systems in support of Space Shuttle processing.

PROJECT JUSTIFICATION:

The present heating, ventilating, and air conditioning (HVAC) equipment at M7-961, M7-1061, and M7-1212 is over 25 years old (Figures 2 and 3) and is beyond life expectancy range. Facilities M7-961 and M7-1212 process the orbital propulsion systems of the Space Shuttle Orbiters, including Orbital Maneuvering Systems (OMS engines) and Reaction Control Systems (thrusters) used for orbit adjustments and attitude control. Building M7-1061 is a remote control room facility for the hazardous processing performed in the Spacecraft Assembly and Encapsulation Facility II. Deterioration of the air handlers is severe due to harsh environmental conditions. Replacement parts are difficult to obtain. Installation of more efficient units will reduce energy consumption and maintenance manpower for repairs. HVAC failures adversely affect processing operations and adversely impact flight schedules.

IMPACT OF DELAY:

If the proposed project is not approved, the present units will continue to be used with long downtime periods for repair. There is no backup support for this equipment in case of failure.

PROJECT DESCRIPTION:

The project consists of replacing condenser units, air handlers, chillers and associated piping and electronic controls in Buildings M7-961, M7-1061, and M7-1212 (Figure 3). Specifically, the work includes nine condensers, eleven air handlers, two chillers, associated piping and controls.

PROJECT COST ESTIMATE: Based on a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$2,100,000</u>
Demolition.....	LS	---	---	280,000
Arch/Structural.....	LS	---	---	70,000
Mechanical.....	LS	---	---	1,600,000
Electrical.....	LS	---	---	<u>150,000</u>
Total.....				<u>\$2,100,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Site Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

**LOCATION PLAN
JOHN F. KENNEDY SPACE CENTER, FLORIDA**



JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
REPLACE HVAC SYSTEM - HMF COMPLEX

SITE PLAN
PAYLOAD/HYPERGOL TEST AREA

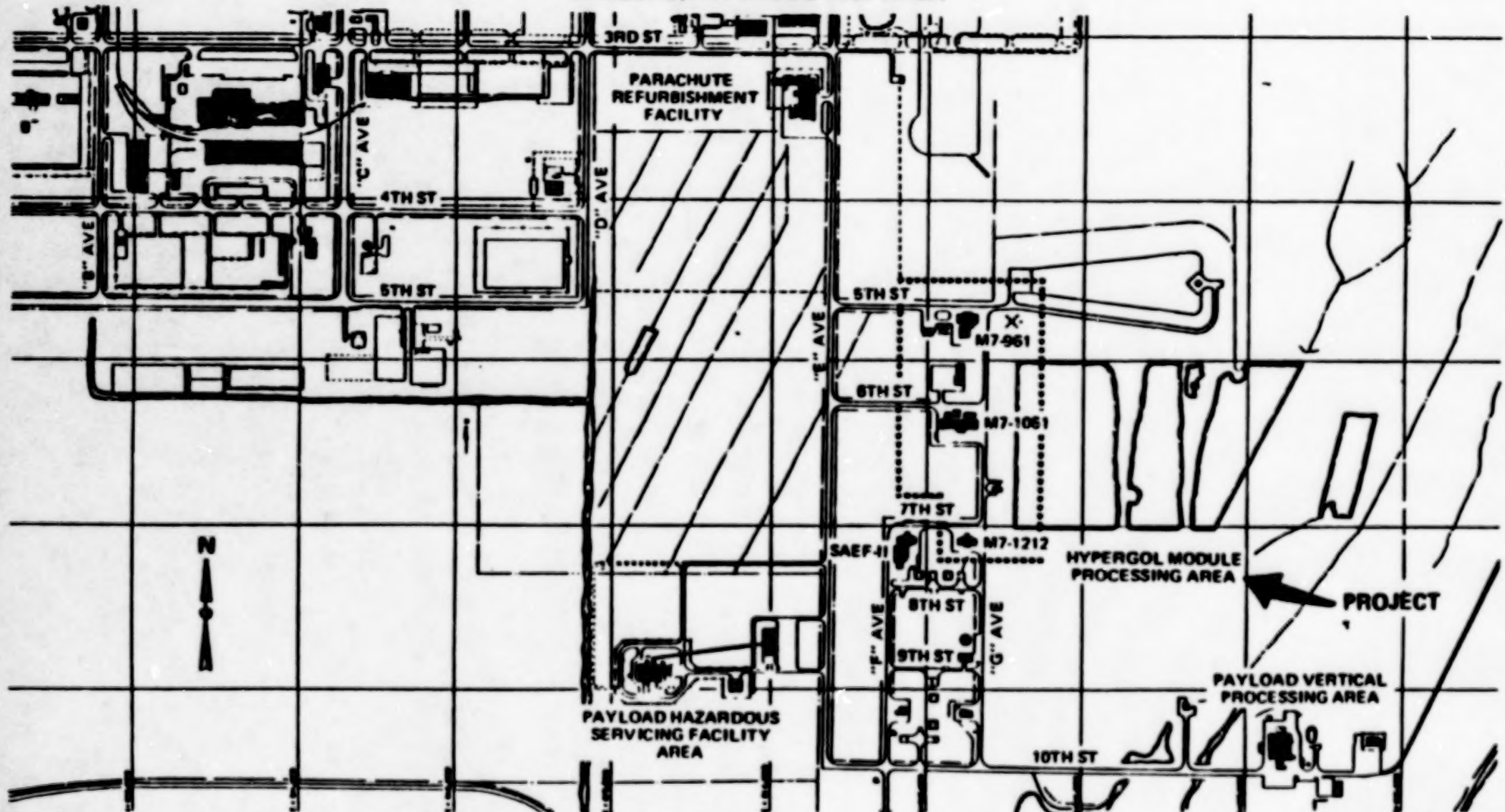


FIGURE 2

CF 2-30

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Replace Operations and Checkout Building West Cooling Tower

INSTALLATION: John F. Kennedy Space Center

FY 1991 CoF Estimate: \$1,000,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$105,000	---	\$ 105,000
Capitalized Investment.....	---	<u>\$51,530,887</u>	<u>51,530,887</u>
Total.....	<u>\$105,000</u>	<u>\$51,530,887</u>	<u>\$51,635,887</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the demolition of the existing Operations and Checkout (O&C) Building west cooling tower and the construction of a new two cell masonry tower with related pumps, piping, and controls. The existing tower is 20 years old and has deteriorated to the point where it can no longer be repaired.

PROJECT JUSTIFICATION:

The present wooden cooling tower has deteriorated to the point that it can only function at 60 percent of its design capacity. The deterioration has caused excessively high maintenance costs and the tower has become a fire hazard. The existing fire suppression system requires excessive maintenance due to severe corrosion. The cooling tower is an integral part of the Heating, Ventilating, and Air Conditioning (HVAC) system for the O&C Building payload processing area, and it cannot fully support critical payload processing cooling requirements due to its decreased capacity.

IMPACT OF DELAY:

A delay in this project risks loss of HVAC support to the O&C payload processing activities. Since the facility directly supports payload processing, failure could result in direct impact to the Shuttle flight schedule by delaying the processing time of payloads. In addition, further delay will increase maintenance and repair costs.

PROJECT DESCRIPTION:

The project provides for the removal of the existing wooden cooling tower and associated equipment and replacement with a new two-cell masonry tower with ceramic fill. Condenser water pumps and associated piping will be replaced.

PROJECT COST ESTIMATE: Based on in-house estimates and related construction cost indexes.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$1,000,000</u>
Demolition.....	LS	1	---	50,000
Civil/Structural.....	LS	1	---	140,000
Mechanical.....	LS	1	---	785,000
Electrical.....	LS	1	---	25,000
Total.....				<u>\$1,000,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Site Plan Figure 3 - Site View

OTHER EQUIPMENT SUMMARY: None

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
REPLACE O & C BUILDING WEST COOLING TOWER

LOCATION PLAN
JOHN F. KENNEDY SPACE CENTER, FLORIDA



FIGURE 1

**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
REPLACE O & C BUILDING WEST COOLING TOWER**

**SITE PLAN
KSC INDUSTRIAL AREA**

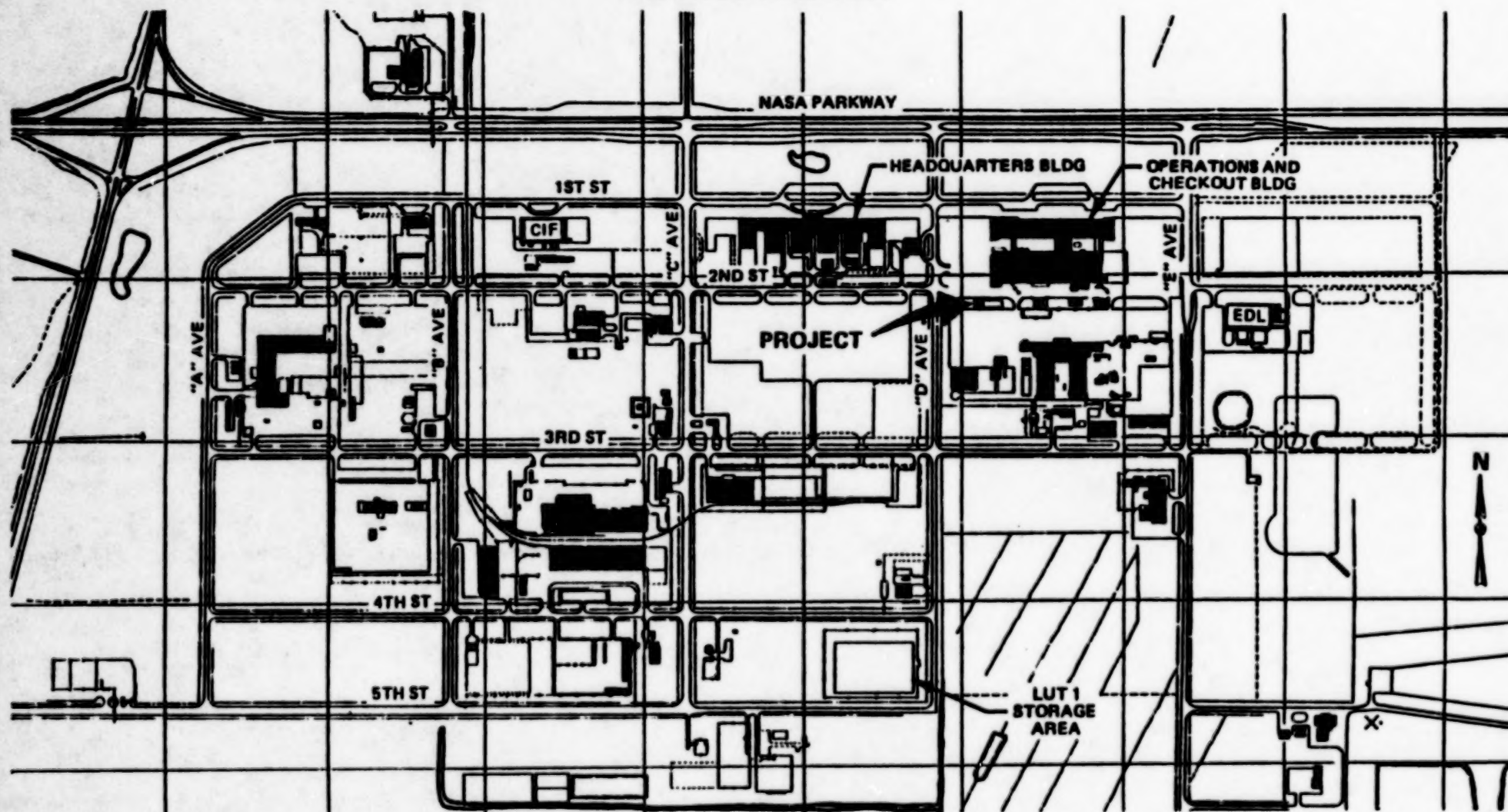


FIGURE 2

CF 2-35

**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
REPLACE O&C BUILDING WEST COOLING TOWER**

SITE VIEW

PROJECT

FIGURE 3

NO VEHICLE

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Restoration of Heavy Equipment Area

INSTALLATION: John F. Kennedy Space Center

FY 1991 CoF Estimate: \$900,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$108,800	---	\$108,800
Capitalized Investment.....	---	<u>\$314,950</u>	<u>314,950</u>
Total.....	<u>\$108,800</u>	<u>\$314,950</u>	<u>\$423,750</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the replacement of temporary, substandard facilities and trailers in the heavy equipment area. The project will provide a high bay addition to the heavy equipment maintenance building, a high crew (personnel who work at exposed heights) building to replace temporary high crew facilities, and an operations building for heavy equipment maintenance personnel.

PROJECT JUSTIFICATION:

The existing High Crew Facility consists of a dilapidated trailer and a maintenance bay. These facilities are very unsafe and unsecure. Most of the rigging equipment utilized by the high crew members is stored in makeshift tents and subject to weather damage and deterioration. This results in damage to rigging that could lead to a serious accident. Adequate protected storage for rigging and scaffolds is required.

The Heavy Equipment Operations Facility will consolidate the engineering, supervisory, and administrative personnel in one area. These people are presently housed primarily in trailers, without restrooms, washup, and training areas. The work crews are widely dispersed and have difficulty coordinating their maintenance functions.

The maintenance high bays are required to service over-height equipment which is presently being maintained either out in the open or under makeshift tents. The present mode of operation curtails most of the maintenance activities on the large pieces of equipment during inclement weather. This in turn increases manpower costs and creates severe safety hazards.

IMPACT OF DELAY:

A delay in implementing this project will cause continued operations in unsafe conditions. Risk of equipment failure is increased due to the outside storage and maintenance. The risk of injury will remain high and essential operations will continue to be fragmented and scattered, causing increased operations cost due to inefficiency.

PROJECT DESCRIPTION:

A 2,750-square-foot addition to the heavy equipment maintenance building, a 4,550-square-foot high crew building, and a 3,250-square-foot operations building will be provided by this project. Pre-engineered metal buildings and building additions will match the construction of existing facilities. The shops for maintenance will include a pit for under-chassis servicing of heavy equipment, storage for materials, concrete floors, inside plumbing, and adequate electric power. The existing temporary facilities will be demolished.

PROJECT COST ESTIMATE: Based on cost of similar KSC facilities.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$900,000</u>
Site Work.....	LS	---	---	130,000
Arch/Structural.....	LS	---	---	380,000
Mechanical.....	LS	---	---	170,000
Electrical.....	LS	---	---	220,000
 Total.....				 <u>\$900,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Site Plan Figure 3 - Plan View

OTHER EQUIPMENT SUMMARY: Noncollateral equipment funded from R&PM at a cost of approximately \$300,000 will be required.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None.

**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
RESTORATION OF HEAVY EQUIPMENT AREA**

**LOCATION PLAN
JOHN F. KENNEDY SPACE CENTER, FLORIDA**



FIGURE 1

CF 2-40

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
RESTORATION OF HEAVY EQUIPMENT AREA

SITE PLAN
CONTRACTORS ROAD AREA

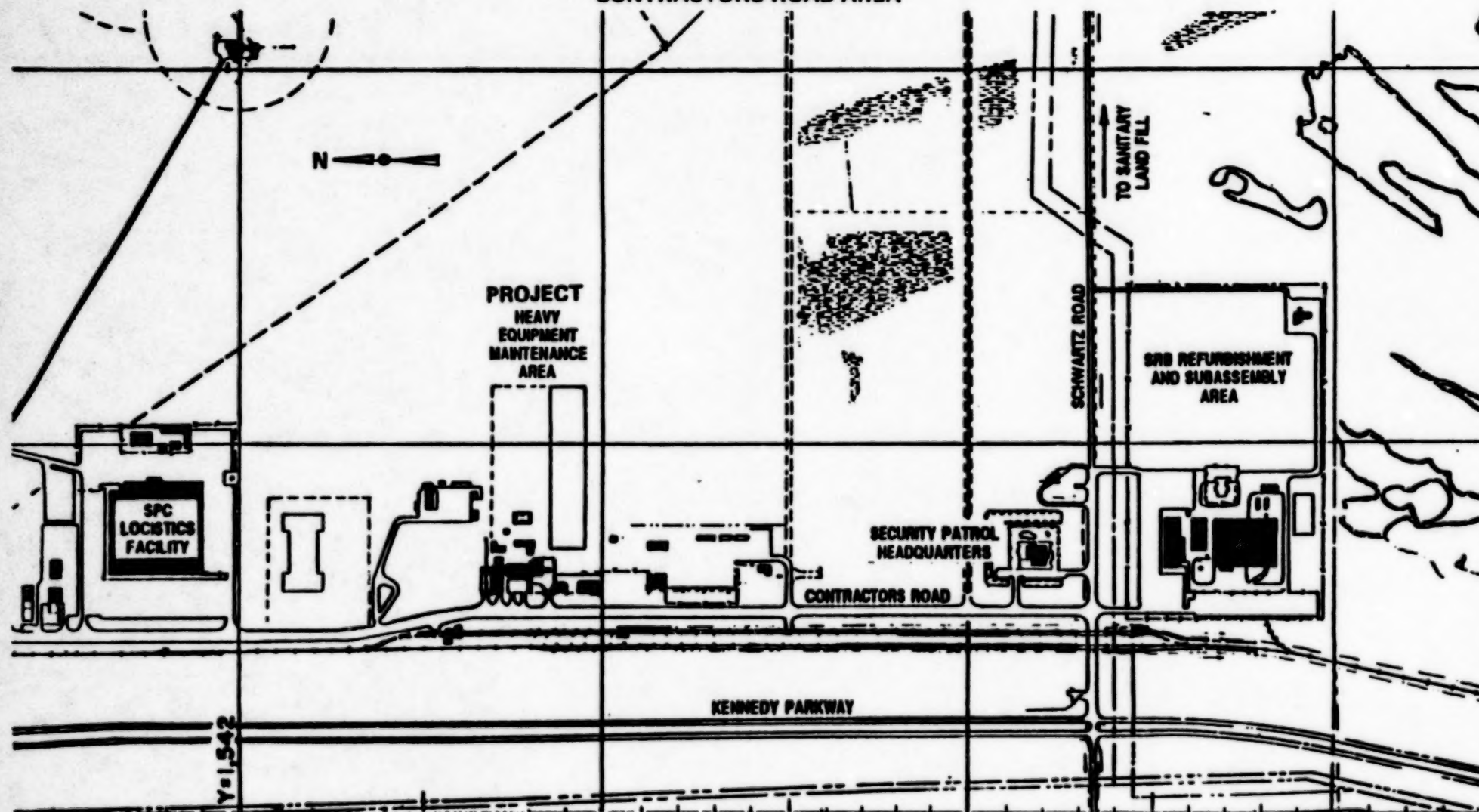


FIGURE 2

CF 2-41

PLAN VIEW



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Upgrade Orbiter Processing Facility High Bay
Heating, Ventilating and Air-Conditioning System

INSTALLATION: John F. Kennedy Space Center

FY 1991 CoF Estimate: \$3,300,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$297,000	---	\$ 297,000
Capitalized Investment.....	---	\$41,516,947	<u>41,516,947</u>
Total.....	<u>\$297,000</u>	<u>\$41,516,947</u>	<u>\$41,813,947</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the upgrade of the Orbiter Processing Facility (OPF) Heating, Ventilation and Air Conditioning (HVAC) system to better handle extremes in temperature and humidity, and replacement of air handlers no. 4 and no. 5 because of deterioration due to age and corrosion.

PROJECT JUSTIFICATION:

The OPF HVAC System was originally designed for a maximum outside temperature of 95 degrees Fahrenheit. During the summer of 1987 temperatures were recorded in excess of 100 degrees Fahrenheit for approximately 20 consecutive days. In addition, a project modified the Payload Air Wash System over the Orbiter Cargo Bay which diminished the capability of the high bay HVAC system to handle high temperature loads. The result is that high bay environmental parameters are not being met 50 percent of the time during summer months. Additional cooling capacity is essential.

Replacement of air handlers no. 4 and no. 5 is also required to ensure that temperature/humidity control can continue to be maintained in the OPF. The existing air handlers are more than 12 years old and have become structurally unsound due to the deterioration of the supporting structural steel as well as the interior framework. The control system has experienced extensive corrosion due to exposure, further exacerbating the capability to maintain temperature/humidity conditions in the OPF.

IMPACT OF DELAY:

Failure to approve and implement this project may impact Shuttle processing schedules due to equipment breakdown. During extreme temperature and humidity conditions the OPF HVAC will continue to be inadequate and jeopardize major functions.

PROJECT DESCRIPTION:

The project provides for refurbishment of the HVAC control system and ductwork for each OPF High Bay (Figures 2 and 3), the addition of a 150-ton precool chilled water coil on the outside air intake on the four air handler units serving the high bay and the complete replacement of air handlers no. 4 and no. 5. The project also includes structural upgrades, piping and ductwork modifications.

PROJECT COST ESTIMATE: Based on a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$3,300,000</u>
Demolition.....	LS	---	---	250,000
Civil/Structural.....	LS	---	---	49,000
Mechanical.....	LS	---	---	2,716,000
Electrical.....	LS	---	---	285,000
Total.....				<u>\$3,300,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Site Plan Figure 3 - Site View

OTHER EQUIPMENT SUMMARY: None

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
UPGRADE OPF HIGH BAY HVAC SYSTEM**

**LOCATION PLAN
JOHN F. KENNEDY SPACE CENTER, FLORIDA**

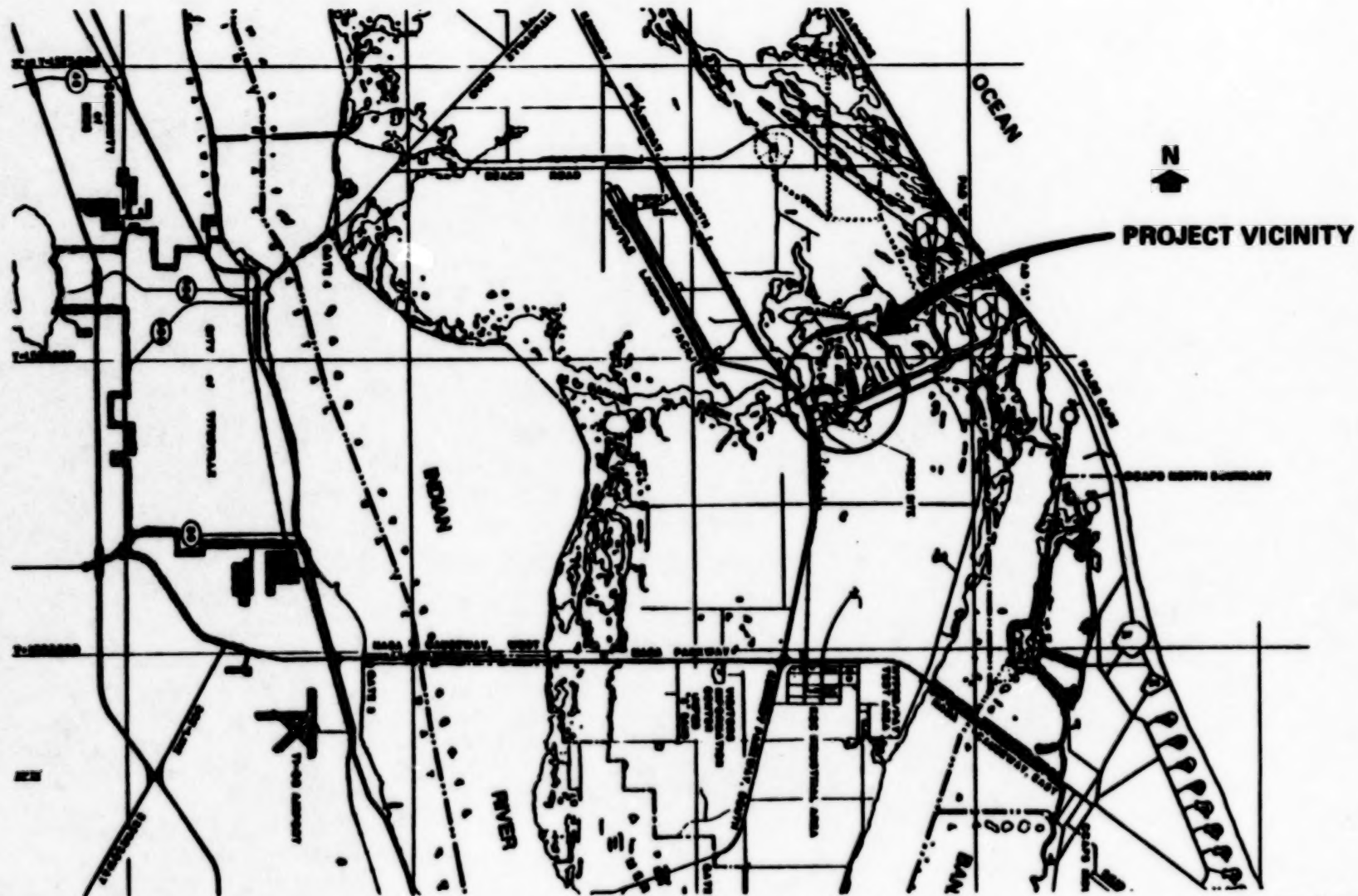


FIGURE 1

CF 2-46

**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
UPGRADE OPF HIGH BAY HVAC SYSTEM**

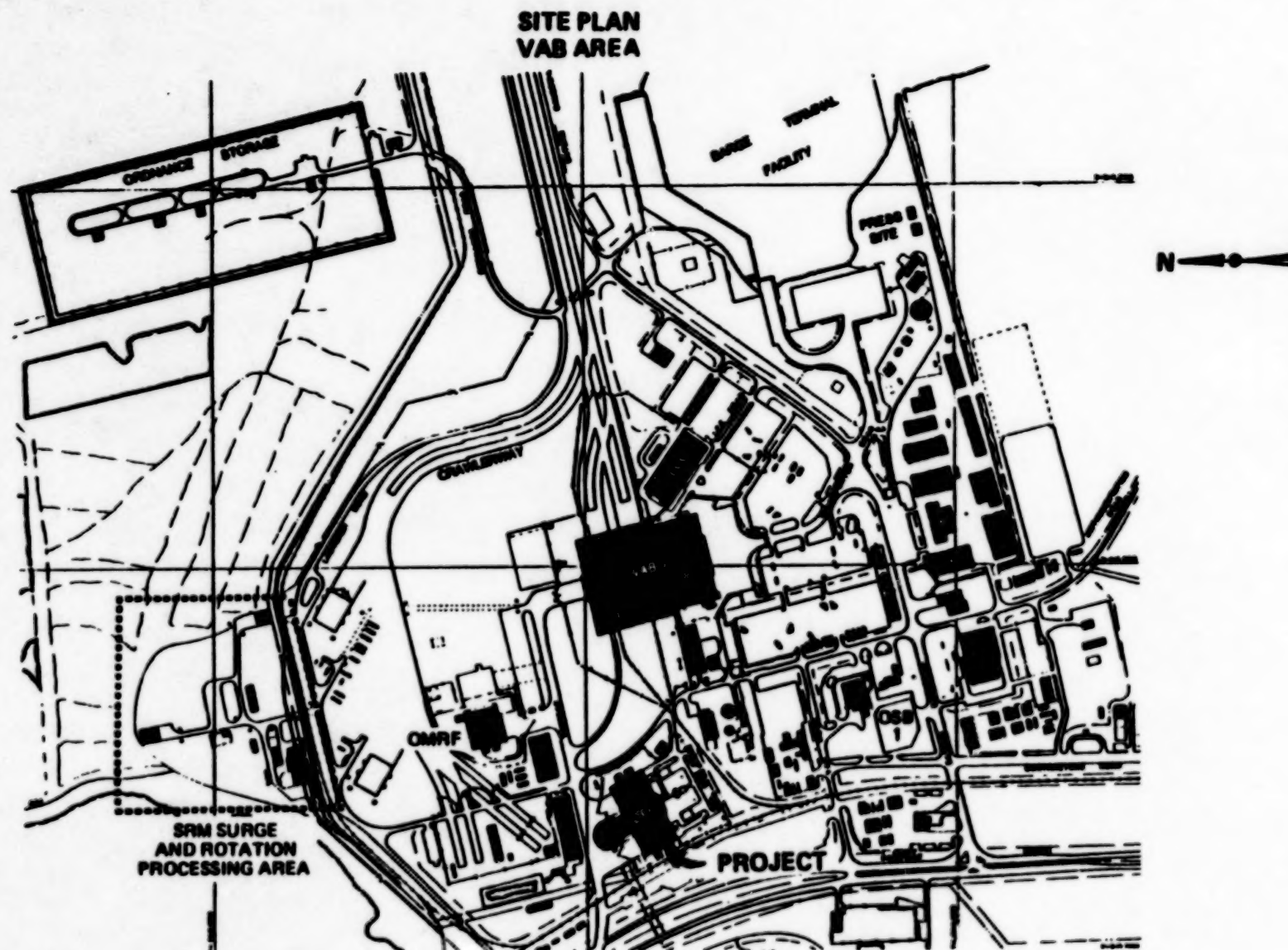


FIGURE 2

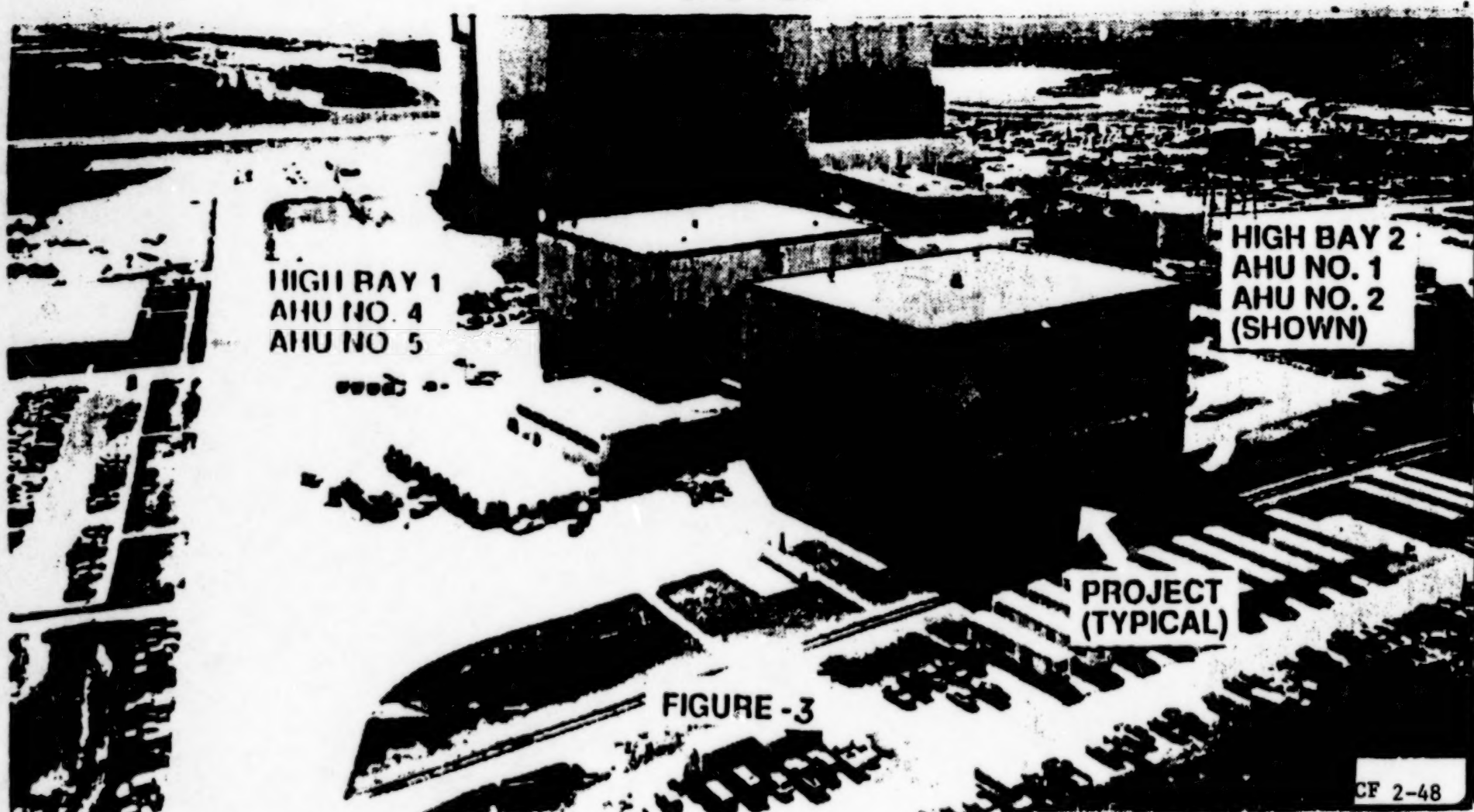
CF 2-47

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES

UPGRADE OPF HIGH BAY HVAC SYSTEM



SITE VIEW



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Upgrade of Yundum International Airport to Full Transoceanic Abort Landing Site

INSTALLATION: John F. Kennedy Space Center

FY 1991 CoF Estimate: \$3,400,000

LOCATION OF PROJECT: Yundum Airport, Banjul, The Gambia

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project.

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF funding.....	\$238,000	\$3,520,000	\$2,758,000
Capitalized investment.....	---	----	---
Total.....	<u>\$238,000</u>	<u>\$3,520,000</u>	<u>\$2,758,000</u>

SUMMARY PURPOSE AND SCOPE:

The Space Shuttle requires a Transoceanic Abort Landing (TAL) site, back-up TAL site and contingency landing sites for each mission. For recent 28⁰ launches from the Kennedy Space Center (KSC) in Florida, overseas TAL and contingency sites have been designated in Ben Guerir, Morocco; Moron, Spain; and Yundum International Airport in Banjul, The Gambia. This project provides for additions to the Yundum airport to include a separate safing pad, additional storage space for landing/navigational aids, and support structures to relocate runway and nav aids for Runway 14. These site improvements are required to upgrade this location to a full-up TAL capability. Necessary agreements with the Gambian government are in place.

PROJECT JUSTIFICATION:

To assure Space Shuttle crew safety and orbiter survival for all credible failure modes during Orbiter ascent, down-range landing sites are an operational requirement. In addition, down-range abort landing sites allow the optimum shaping of the ascent trajectory. This approach affords the opportunity to dedicate the main propulsion propellants for injecting the Orbiter and its payload into its required orbit rather than holding propellants in reserve to power the Orbiter's return to launch site or into a once-around abort orbit. This technique provides 3,000-4,000 pounds of additional propulsion performance which is essential to achieving performance commitments. By previous direction, for return-to-flight status, usable TAL sites must be available.

NASA originally approved Yundum Airfield, The Gambia, as a "2-engine out" 28⁰ contingency landing site. FY 1989 work has further upgraded Yundum to have a minimum TAL capability. This project will further upgrade Yundum to provide optimum landing and turnaround capability in the event of a TAL. Currently, due to the lack of a separate remote safing area, a TAL at Yundum would require closure of this commercial airport for a period of up to two weeks while off-loading hazardous materials. A financial impact to Banjul, which could be passed on to NASA, could include at costs exceeding \$1,000,000 per week. Resumption of "routine" launches increases the probability of such an event occurring and must be planned for to minimize program impacts.

Occasionally, weather conditions at Ben Guerir, the prime TAL site for low inclination flights, can be a constraint to launch. This usually happens in seasons when weather conditions at Yundum are acceptable. Under these conditions, these upgrades to Yundum will also allow its use as a prime weather alternate to Ben Guerir. Missions with maximum weight payloads are included. By contrast, the use of Moron, Spain as a weather alternate is limited to missions with only nominal payloads.

IMPACT OF DELAY:

Deferral of this project may complicate turnaround support if a TAL to Yundum is required resulting in delays in overall Shuttle operations and additional costs.

PROJECT DESCRIPTION:

Runway 32/14 at Yundum is 11,810 feet long and 150 feet wide with 1000 foot under and overruns (to be completed by the FY 89 project). Tactical air navigation (Tacan), Microwave Scanning-Beam Landing System (MSBLS), precision approach path indicator (PAPI), Ball/Bar and Shuttle Orbiter Arresting System (SOAS) Systems are in place to support any contingency landing on Runway 32. This project provides for the addition of a 200 foot by 200 foot safing pad with a 75 foot wide tow way (Figure 1). A storage building enclosing

5,000 square feet is required to protect and maintain expensive landing/navigational aids. Runway 14 landing aids will also be relocated to provide for a full 11,810 foot secondary runway for landings in the opposite direction.

PROJECT COST ESTIMATE:

This cost is based on field inspections, discussions with Gambian officials, and previous design and construction work at this site.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$3,400,000</u>
Safing Pad and Tow Way.....	LS	---	---	2,050,000
Additional Storage Building.....	SF	5,000	\$210.00	1,050,000
Runway 14 Aids.....	LS	---	---	300,000
Total.....				<u>\$3,400,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Site Layout

OTHER EQUIPMENT SUMMARY:

Existing non collateral equipment estimated at approximately \$3,000,000 will be used.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
UPGRADE YUNDUM INTERNATIONAL AIRPORT TO FULL TRANSOCEANIC ABORT
LANDING SITE, BANJUL, THE GAMBIA**

SITE LAYOUT

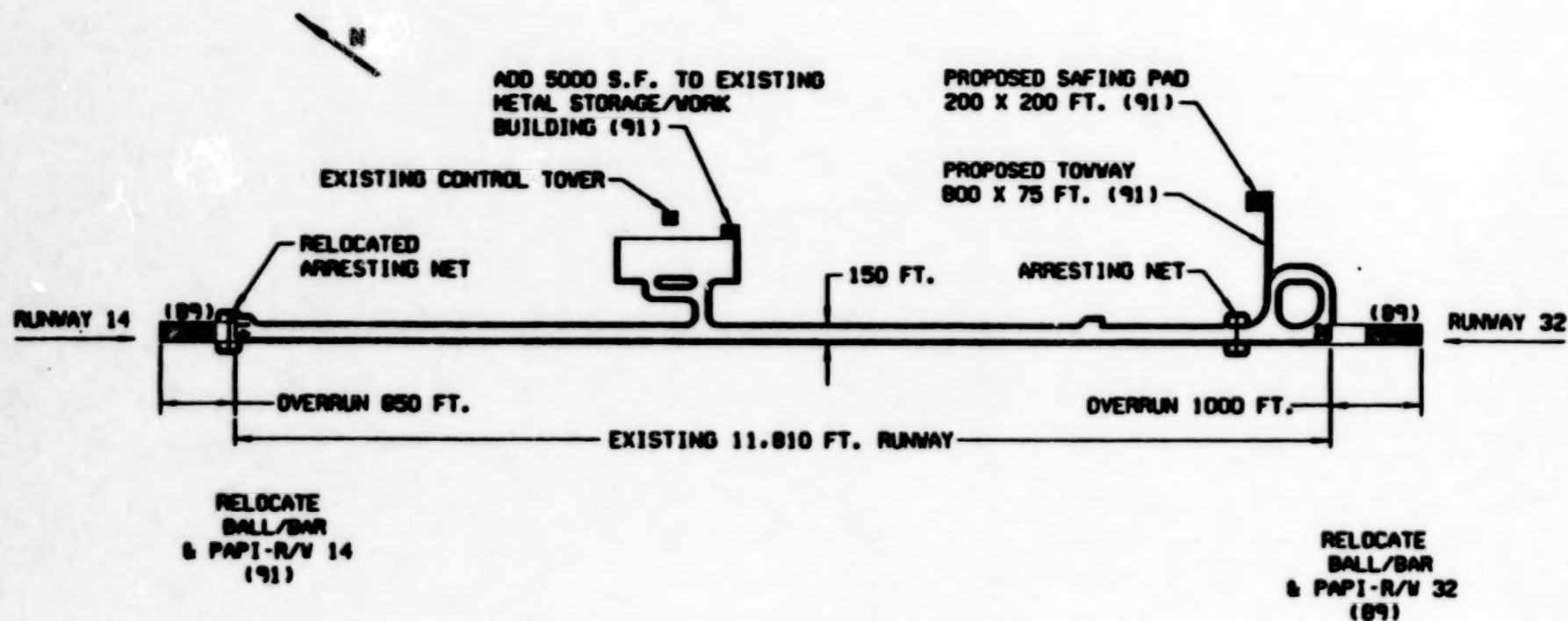


FIGURE 1

CF 2-52

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Repair Condensate System, Main Manufacturing Building

INSTALLATION: Michoud Assembly Facility

FY 1991 CoF Estimate: \$900,000

LOCATION OF PROJECT: New Orleans, Orleans Parish, Louisiana

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project.

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF funding.....	\$93,000	---	\$ 93,000
Capitalized investment.....	---	\$51,797,522	51,797,522
Total.....	<u>\$93,000</u>	<u>\$51,797,522</u>	<u>\$51,890,522</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the replacement of the gravity fed condensate system supporting critical production processes and heating, ventilating, and air conditioning (HVAC) needs in the main manufacturing Building 103. The advanced deterioration of the existing pipes can no longer be repaired and must be replaced. The project includes replacement of approximately 15,000 linear feet of piping, hangers, traps, valves, instrumentation, and accessories from the rooftop fanhouses and various air handling units to the condensate receivers.

CF 2-53

PROJECT JUSTIFICATION:

The condensate system was installed in the 1940s, and has reached the point of severe deterioration from corrosion that requires replacement. This results in large condensate losses due to leaking valves, traps, receivers, and excessive downtime for repairs. In some areas, the condensate line is located 40 feet above the manufacturing floor, resulting in safety hazards to both personnel and equipment from the leaking chemically treated water. As a result of many outages, the ability to maintain the proper environment in the 43 acre building which manufactures the Space Shuttle external tank is at risk. Repairs have become very costly due to the extent of the pipe deterioration. Quick patchwork repairs such as pipe clamps can no longer be used and replacement of the system is necessary.

IMPACT OF DELAY:

Delay of this project will result in increased numbers and duration of unscheduled outages of the Building 103 HVAC system. Cost of repairs will increase as failures become more frequent and more severe. Additionally, energy costs will continue to increase as the condensate losses rise.

PROJECT DESCRIPTION:

This project includes the removal and replacement of approximately 8,000 linear feet of main condensate return lines and 7,000 feet of lateral lines. Hangers, traps, valves, instruments and associated equipment from the rooftop fanhouses to the condensate receivers will also be removed and replaced. Asbestos insulation on a major portion of the piping will also be replaced.

PROJECT COST ESTIMATE: Based upon a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$900,000</u>
Mechanical.....	Lot	1	900,000	900,000
Total.....				<u>\$900,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Site Plan Figure 2 - Piping Schematic

OTHER EQUIPMENT SUMMARY: None

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

**MICHOUD ASSEMBLY FACILITY
FISCAL YEAR 1991 ESTIMATES
REPAIR CONDENSATE SYSTEM 103
SITE PLAN**

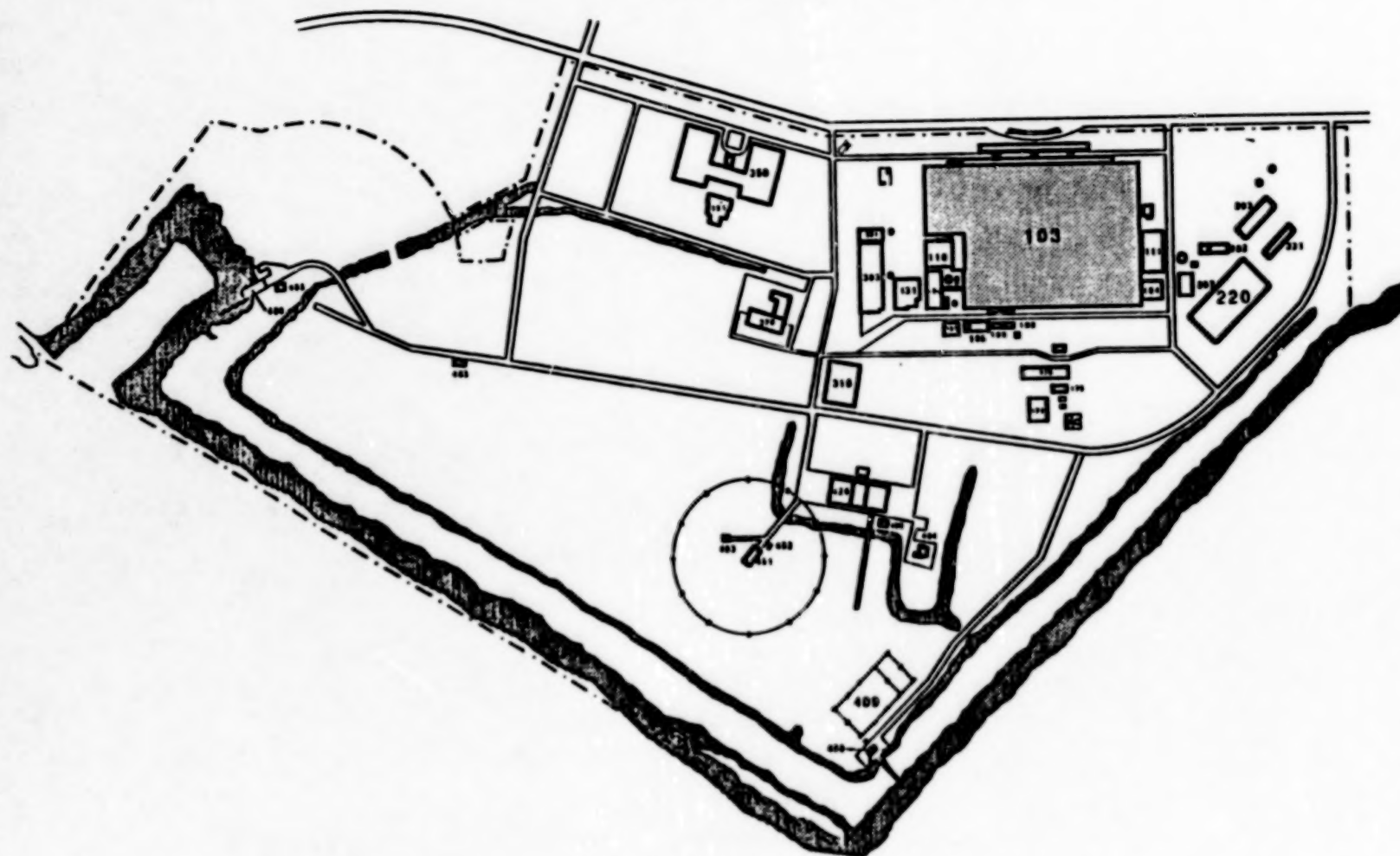


FIGURE 1

CF 2-56

**MICHOUD ASSEMBLY FACILITY
FISCAL YEAR 1991 ESTIMATES
REPAIR CONDENSATE SYSTEM (103)
PIPING SCHEMATIC**

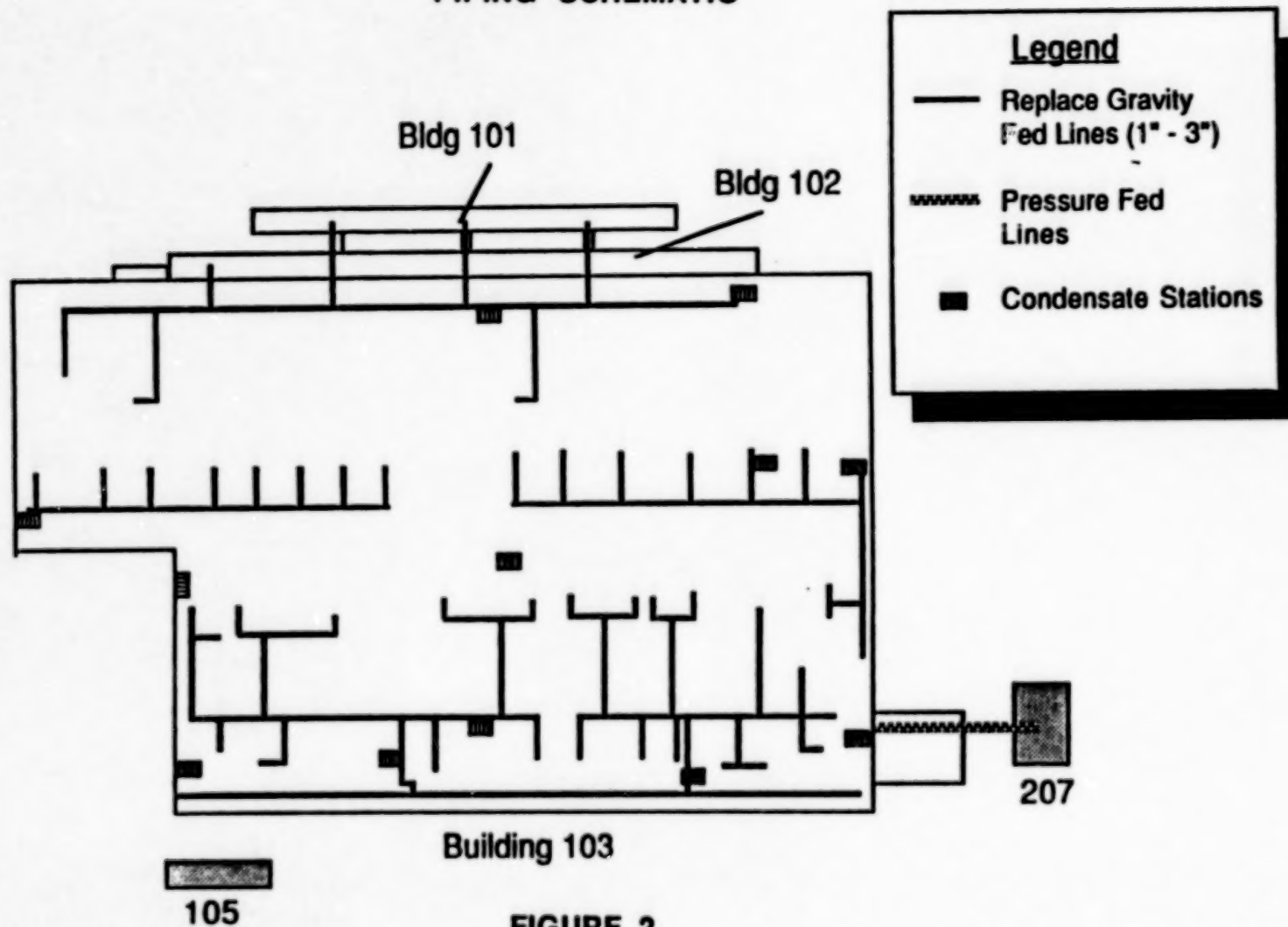


FIGURE 2

CF 2-57

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Construct Project Engineering Facility

INSTALLATION: George C. Marshall Space Flight Center

FY 1991 CoF Estimate: \$17,000,000

LOCATION OF PROJECT: Marshall Space Flight Center, Madison County, Alabama

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project.

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$1,595,000	---	\$1,595,000
Capitalized Investment.....	---	---	---
Total.....	<u>\$1,595,000</u>	<u>---</u>	<u>\$1,595,000</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of a multistory, 140,000-gross-square-foot Project Engineering Facility (Building 4203) at the Marshall Space Flight Center (MSFC). The proposed facility will consist of six floors, plus a basement, and will house approximately 700 people. This facility will provide space for engineers, scientists, program managers and their staff members who are presently located in obsolete, substandard and overcrowded facilities or in off-site leased space.

PROJECT JUSTIFICATION:

This facility will eliminate space deficiencies from current and projected personnel growth in the civil service workforce, which cannot be accommodated in existing facilities. Presently MSFC has more than 1,000 members of its workforce housed in substandard and temporary space. This project will also reduce present and future requirements for off-site leasing of commercial space. Projections indicate that off-site leasing costs will increase from more than \$1,000,000 in FY 1989 to more than \$10,000,000 by FY 1996, if space requirements have to be provided by off-site leasing. This project will provide significant improvements in operational efficiency, eliminate substandard work environments and eliminate costly leases which are presently required and will have to be increased. The benefits of this project are both tangible--simple payback of less than five years, and intangible--a vast improvement in the quality of employee workspace.

IMPACT OF DELAY:

Delay of this project will result in the continued use of substandard and inefficient facilities and a continuing need to lease and occupy facilities off-site, resulting in lost management efficiency and costly outlays to an already strained Research and Program Management budget. Without this facility, MSFC must continue to operate in the present ineffective and costly mode of leasing office space off-site and locating personnel in substandard space.

PROJECT DESCRIPTION:

The Project Engineering Facility will be located in the parking area east of existing Buildings 4201 and 4202. The exterior will be a glass curtain wall system similar to existing designs of Buildings 4200, 4201 and 4202. The building will contain a basement and six floors, having a total net area of about 98,000 square feet.

PROJECT COST ESTIMATE: Based upon a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$17,000,000</u>
Site Work.....	LS	---	---	1,349,700
Architectural/Structural.....	SF	140,000	78.11	10,935,600
Mechanical.....	SF	140,000	16.69	2,335,900
Electrical.....	SF	140,000	16.99	<u>2,378,800</u>
<u>Equipment</u>	---	---	---	---
Total.....				<u>\$17,000,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Artist Concept

OTHER EQUIPMENT SUMMARY: Approximately \$3.5M for communications equipment and furniture.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCT PROJECT ENGINEERING FACILITY

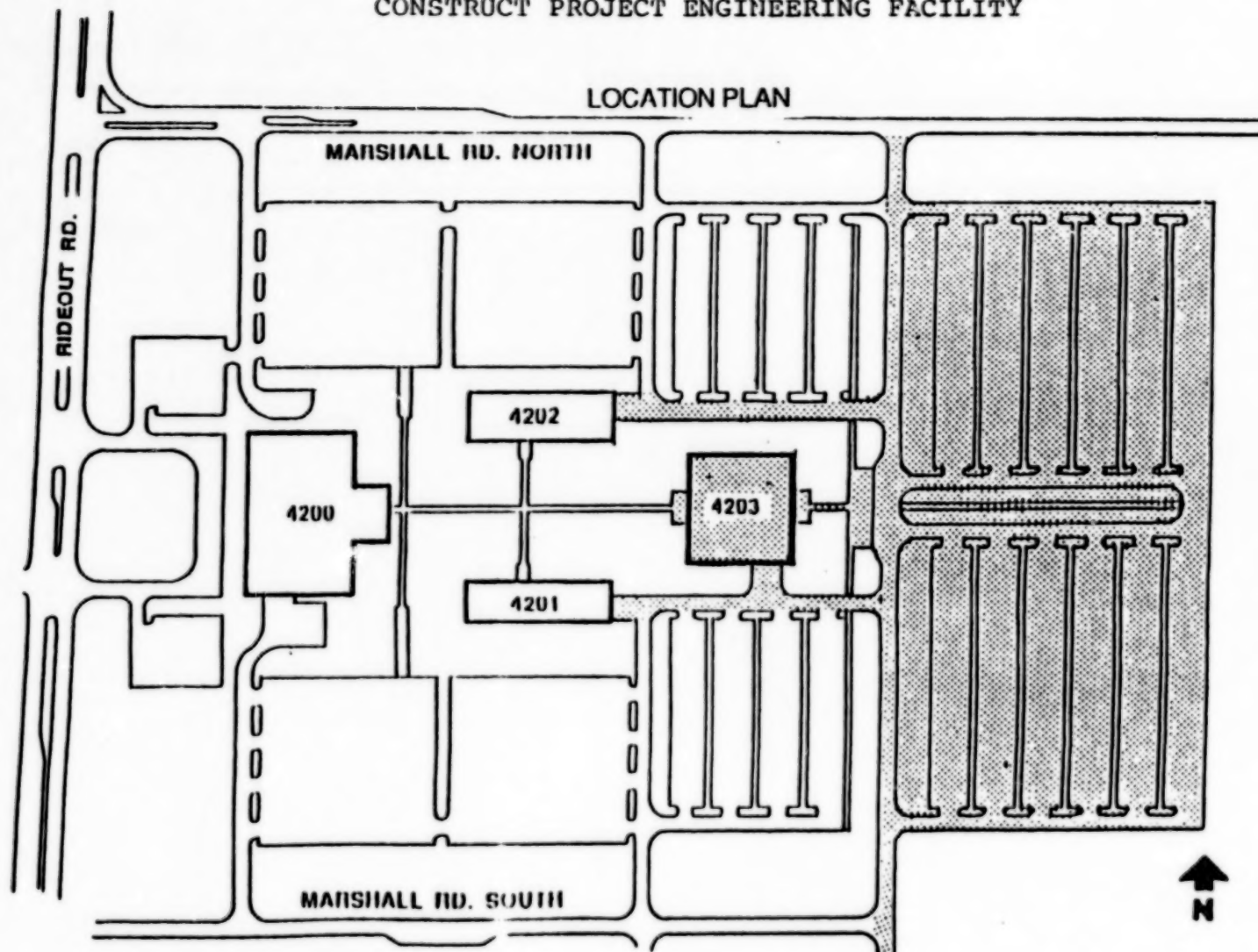


FIGURE 1

CF 2-61

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCT PROJECT ENGINEERING FACILITY

CONCEPT

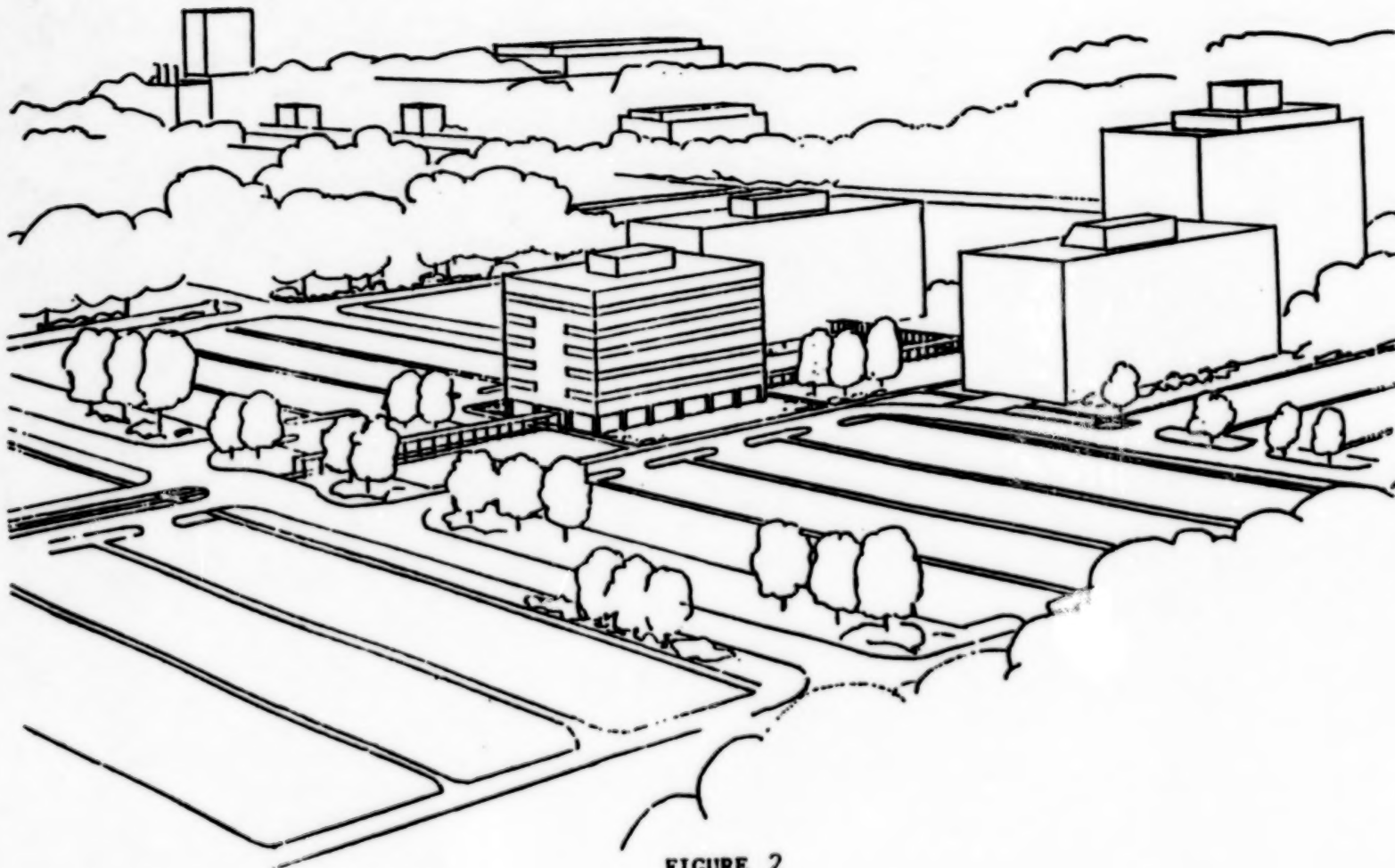


FIGURE 2

CF 2-62

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Restoration of Information and Electronic Systems Laboratory

INSTALLATION: George C. Marshall Space Flight Center

FY 1991 CoF Estimate: \$4,000,000

LOCATION OF PROJECT: Marshall Space Flight Center, Madison County, Alabama

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project.

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$455,000	---	\$ 455,000
Capitalized Investment.....	---	<u>\$10,416,222</u>	<u>10,416,222</u>
Total.....	<u>\$455,000</u>	<u>\$10,416,222</u>	<u>\$10,871,222</u>

SUMMARY PURPOSE AND SCOPE:

This project will completely restore and modernize the "A" Wing of Building 4487 to create an efficient office laboratory/computer complex environment.

PROJECT JUSTIFICATION:

Building 4487, totaling 278,385 square feet, was built in phases beginning in 1957 and has transitioned in use from a laboratory building to an office/laboratory/computer complex. Building 4487 is Marshall Space Flight Center's primary electronics laboratory, supporting current NASA programs as well as research and development for future programs. Installation of laboratory and computer equipment has overloaded both power supply/distribution and HVAC systems, resulting in frequent system failures. The large number of structural modifications accomplished over the years has resulted in a low quality environment in terms of space allocation/configuration and supporting utility systems. Widespread use of asbestos in interior building systems complicates any further piecemeal building modifications. Non-insulated masonry exterior walls and casement windows are energy inefficient. The roof is badly deteriorated and is also energy inefficient.

IMPACT OF DELAY:

An increase in laboratory and computer equipment failures will be experienced due to worsening power distribution and HVAC overloads. Operations and maintenance expenses will continue to increase to support piecemeal roof repairs. Worker productivity and morale will lower as more staff are added to what is already a poorly configured, overloaded and low quality workspace.

PROJECT DESCRIPTION:

This project provides a complete restoration of the "A" Wing of Building 4487. The roof will be replaced and the building exterior will be insulated and receive a new facade, including new windows. Asbestos laden interior walls will be removed; floor, wall and ceiling surfaces will be upgraded. The heating, ventilating and air conditioning (HVAC) system, the power supply and distribution system, and the lighting system will also be replaced.

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PROJECT COST ESTIMATE: Based upon a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$4,000,000</u>
Site Work.....	LS	---	---	---
Architectural/Structural.....	LS	---	---	1,756,500
Mechanical.....	LS	---	---	1,767,700
Electrical.....	LS	---	---	318,500
Asbestos Abatement.....	LS	---	---	157,300
Total.....				<u>\$4,000,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Artist Concept

OTHER EQUIPMENT SUMMARY: None.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Future CoF funding will be requested to restore and modernize other portions of the building.

FISCAL YEAR 1991 ESTIMATES
MARSHALL SPACE FLIGHT CENTER
RESTORATION OF INFORMATION AND ELECTRONIC SYSTEMS LABORATORY
(4487)
SITE PLAN

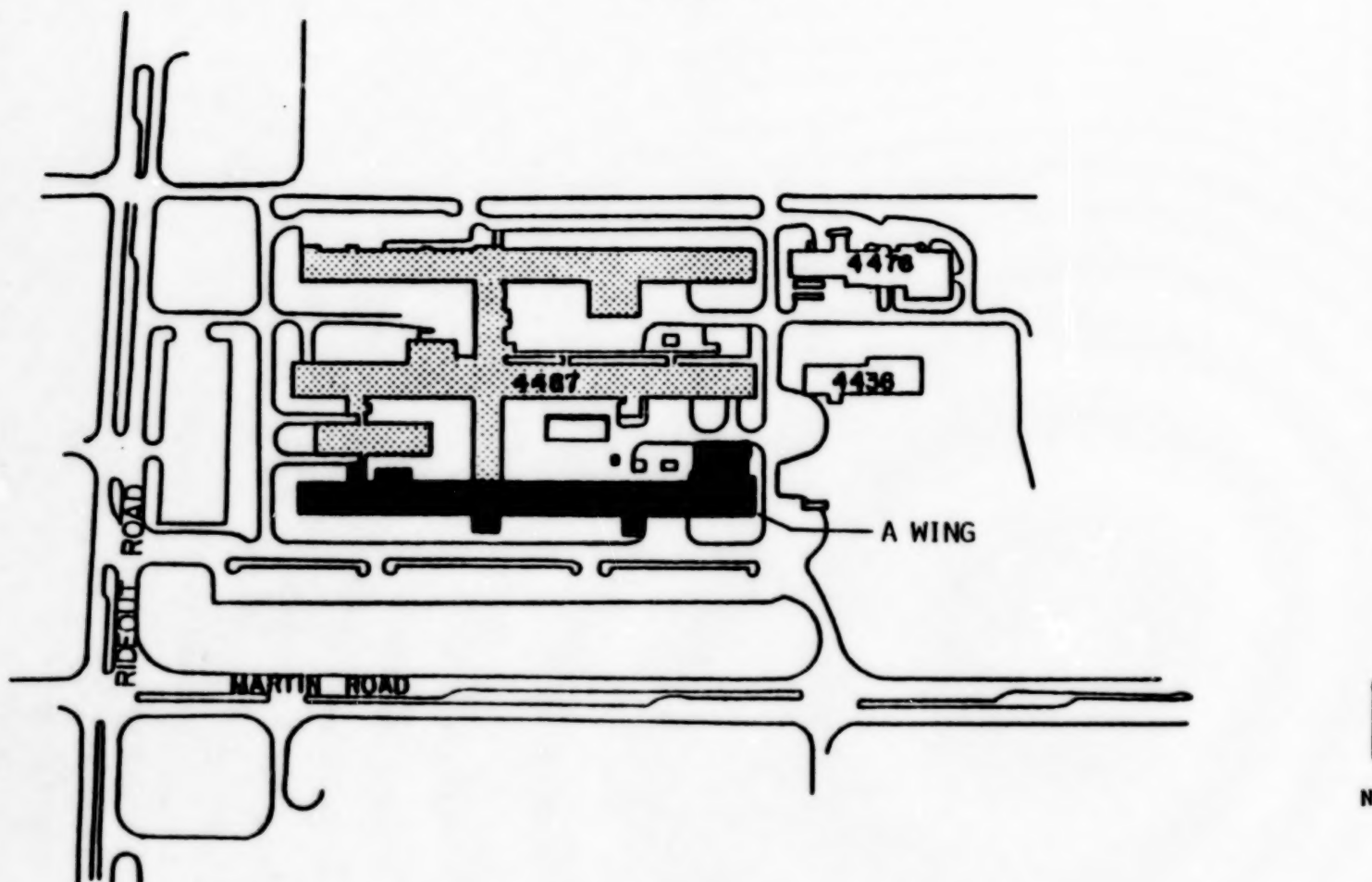
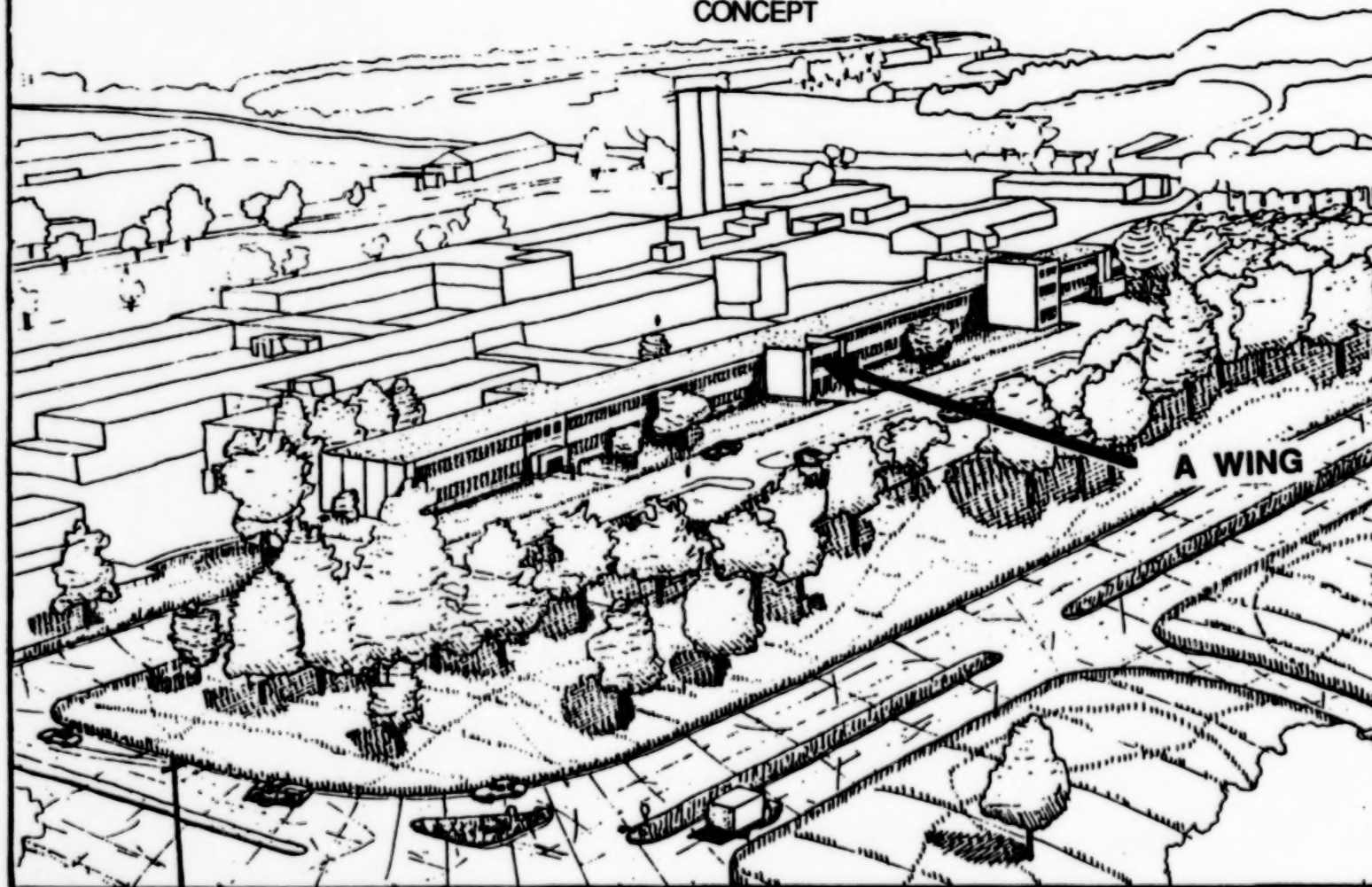


FIGURE 1

CF 2-66

FISCAL YEAR 1991 ESTIMATES
MARSHALL SPACE FLIGHT CENTER
RESTORATION OF INFORMATION AND
ELECTRONICS SYSTEMS LABORATORY (4487)
CONCEPT



A WING

CF 2-67

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Rehabilitation of Hydrogen Transfer Facility

INSTALLATION: John C. Stennis Space Center

FY 1991 CoF Estimate: \$2,700,000

LOCATION OF PROJECT: Stennis Space Center, Hancock County, Mississippi

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$202,500	\$ ---	\$202,500
Capitalized Investment.....	---	<u>161,254</u>	<u>161,254</u>
Total.....	<u>\$202,500</u>	<u>\$161,254</u>	<u>\$363,754</u>

SUMMARY PURPOSE AND SCOPE:

The liquid hydrogen (LH₂) supply at Stennis Space Center (SSC) is totally dependent upon barge transportation, which is a single source of transport from a single commercial source of supply. Interruption of the transportation system or the loss of the production facility would have a significant impact on the Space Shuttle Main Engine testing program. This project will provide for the restoration of an existing barge terminal facility to accommodate three independent methods of barge, truck trailer and rail car delivery of LH₂.

CF 2-68

PROJECT JUSTIFICATION:

Existing LH₂ storage and transport facilities at SSC (Figure 1) consist of three barges with a total capacity of 750,000 gallons. These barges serve two functions: 1) bulk delivery of LH₂ from the only available commercial supplier located in New Orleans; and 2) fuel supply to test stand locations during extended duration SSME testing.

These two functions each have an unacceptable associated risk: 1) Extended duration testing planned for the next generation SSME development program will exceed the shipment/storage capacity of the existing three-barge system; 2) The barge delivery system is subject to several single point failure risks; shutdown of the New Orleans production plant, waterway obstruction, and/or barge failure.

The restoration of the LH₂ barge terminal and transfer facility (Figure 2) would provide the capability to receive LH₂ from alternate sources, thereby reducing the adverse impact upon the SSME test program of a single point failure in the delivery system. The implementation of this project would also provide an increased competitive market for LH₂ procurement among suppliers with ground transport capabilities.

IMPACT OF DELAY:

Delay in the implementation of this project will subject the SSME testing programs to the undue risk of long term delay should a single point failure occur at the LH₂ production facility or within the barge transport system.

PROJECT DESCRIPTION:

This project provides for the renovation of the LH₂ transfer system to include the rehabilitation of the three existing dock structures, reactivation of three tractor trailer unloading stations, reactivation of two railroad car unloading stations, and construction of one additional tractor trailer unloading station.

PROJECT COST ESTIMATE: Based upon a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$2,700,000</u>
Earthwork; Concrete; Shell.....	LS	---	\$86,000	86,000
Rehab. Docking Fac.....	LS	---	262,000	262,000
Fence; Platforms; Decks.....	LS	---	75,000	75,000
LH ₂ System.....	LS	---	559,000	559,000
Gaseous Hydrogen (GH ₂) System.....	LS	---	481,000	481,000
GN ₂ Purge.....	LS	---	345,000	345,000
Deluge System.....	LS	---	110,000	110,000
Hydrogen Flare Stack-New.....	LS	---	123,000	123,000
Electrical.....	LS	---	659,000	659,000
Total.....				<u>\$2,700,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Map Figure 2 - Site Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE CoF FUNDING REQUIRED TO COMPLETE THIS PROJECT None

FISCAL YEAR 1991 ESTIMATES

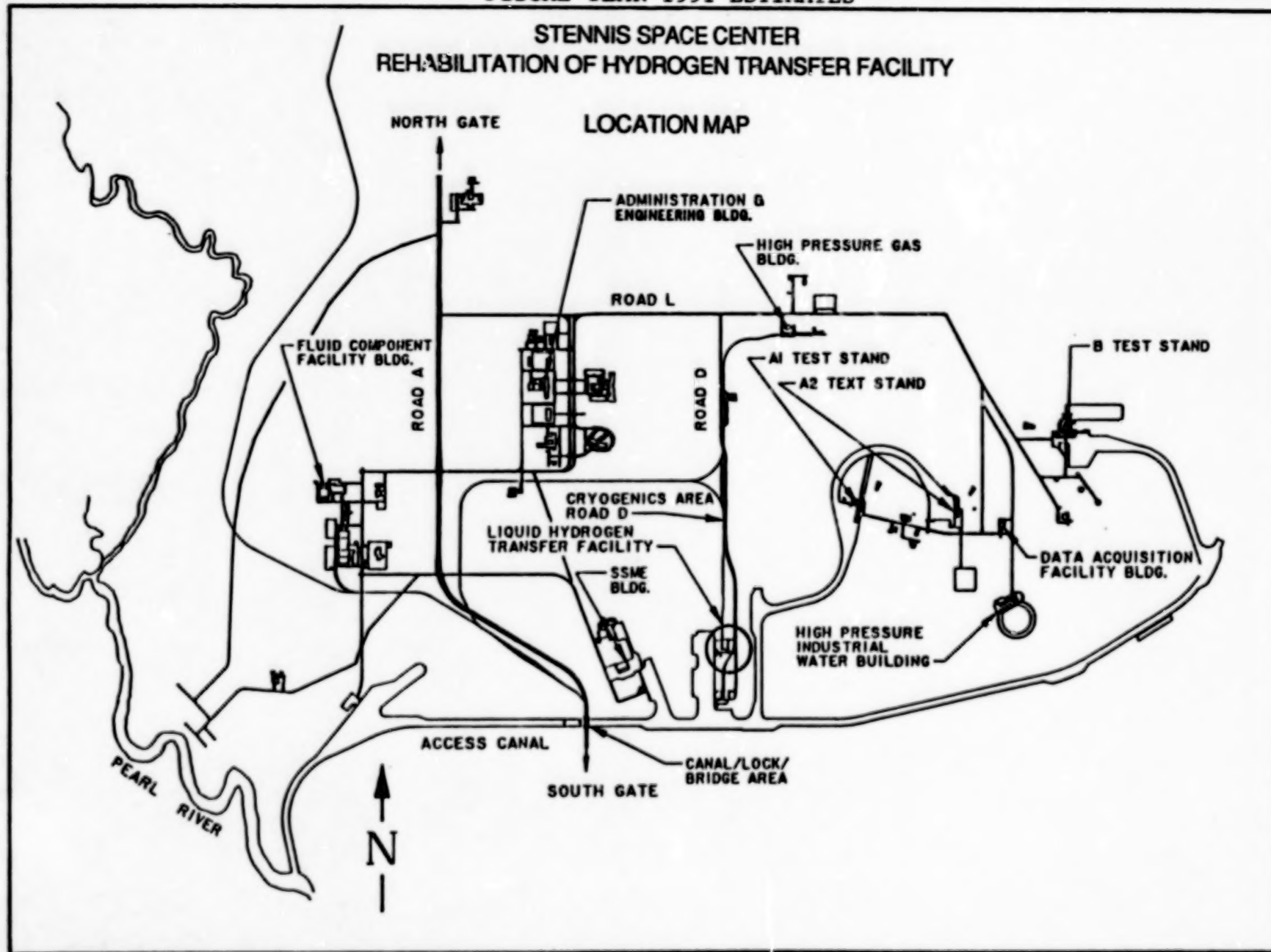


FIGURE 1

CF 2-71

FISCAL YEAR 1991 ESTIMATES
STENNIS SPACE CENTER
REHABILITATION OF HYDROGEN TRANSFER FACILITY

SITE PLAN

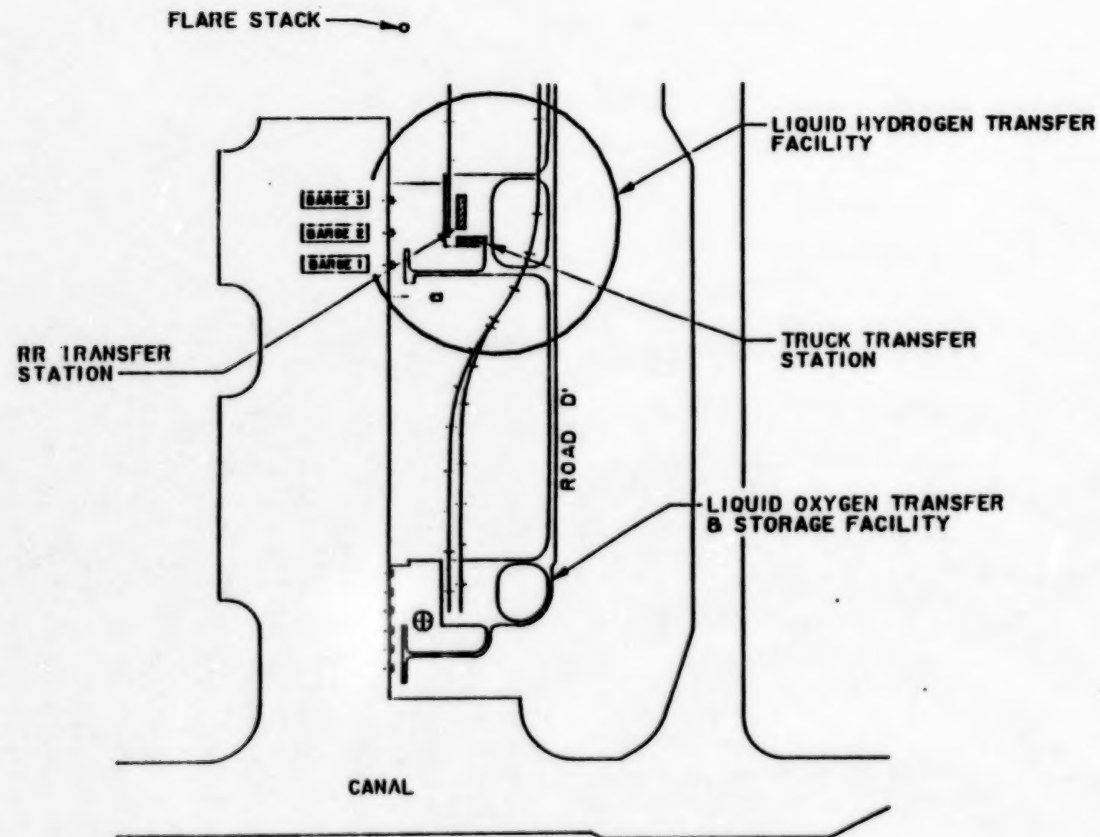


FIGURE 2

CF 2-72

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Restoration of Space Shuttle Main Engine Test Complex "A"

INSTALLATION: John C. Stennis Space Center

FY 1991 CoF Estimate: \$2,800,000

LOCATION OF PROJECT: Stennis Space Center, Hancock County, Mississippi

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$249,000	---	\$ 249,000
Capitalized Investment.....	---	<u>\$60,844,975</u>	<u>60,844,975</u>
Total.....	<u>\$249,000</u>	<u>\$60,844,975</u>	<u>\$61,093,975</u>

SUMMARY PURPOSE AND SCOPE:

This project upgrades the Space Shuttle Main Engine (SSME) Test Complex "A" to insure the continued safe and reliable performance of SSME test operations.

PROJECT JUSTIFICATION:

The SSME Test Complex "A" was originally constructed in the mid 1960's as a static firing test stand for the Apollo Program. After modification to support the SSME Program, constant exposure to adverse environmental conditions and continuous use of the facility has resulted in extensive structural corrosion and deterioration of the test position and supporting facilities. The existing elevators were designed for freight use but have had to be used for personnel. Despite numerous attempts to reduce hazardous situations, injuries continue to occur from use of these elevators for personnel. Replacement of these elevator cars and doors will eliminate personnel injuries. The heating, ventilation, and air conditioning (HVAC) systems include original pneumatic systems which have exceeded their normal 20-year life expectancy and have become failure-prone. Air handling systems in Buildings 4410 and 4995 have extensive maintenance problems and need complete replacement. Building 440, the Emergency Power and Heating Plant requires replacement of unit heating systems and controls, and exhaust systems and controls.

IMPACT OF DELAY:

Delay of this project may result in adverse effects on the SSME test operations due to the continued deterioration of the test positions and supporting facilities. In addition, the elevators will continue to be a source of personnel injury.

PROJECT DESCRIPTION:

Work will include the rehabilitation of the elevator cars and doors on the A-1 and A-2 Test Stands; electrical rehabilitation including the replacement of failed and/or corroded 110 volt explosion-proof receptacles and explosion-proof light fixtures; reconditioning existing electrical boxes and replacing corroded conduits and fittings; rehabilitation of the SSME Test Stands A-1 and A-2 structural elements; and the modification/upgrading of both the Utility Control System and the HVAC systems. Asbestos insulation board located underneath the checker plate floor decking on Level 7 of the A-1 and A-2 Test Stands will be removed. The project also includes replacement of corroded grating, handrails, stair treads, attachment bolts, and support steel.

PROJECT COST ESTIMATE: Based upon a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$2,800,000</u>
Structural Rehabilitation.....	LS	---	---	1,482,000
Electrical Rehabilitation.....	LS	---	---	64,000
Elevator Rehabilitation.....	LS	---	---	373,000
Piping Rehabilitation.....	LS	---	---	67,000
High Voltage System.....	LS	---	---	25,000
UCS Upgrade.....	LS	---	---	555,000
HVAC Upgrade.....	LS	---	---	234,000
 Total.....				 <u>\$2,800,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - SSC Location Map Figure 2 - Site Plan

OTHER EQUIPMENT SUMMARY: None

FUTURE CoF FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

FISCAL YEAR 1991 ESTIMATES

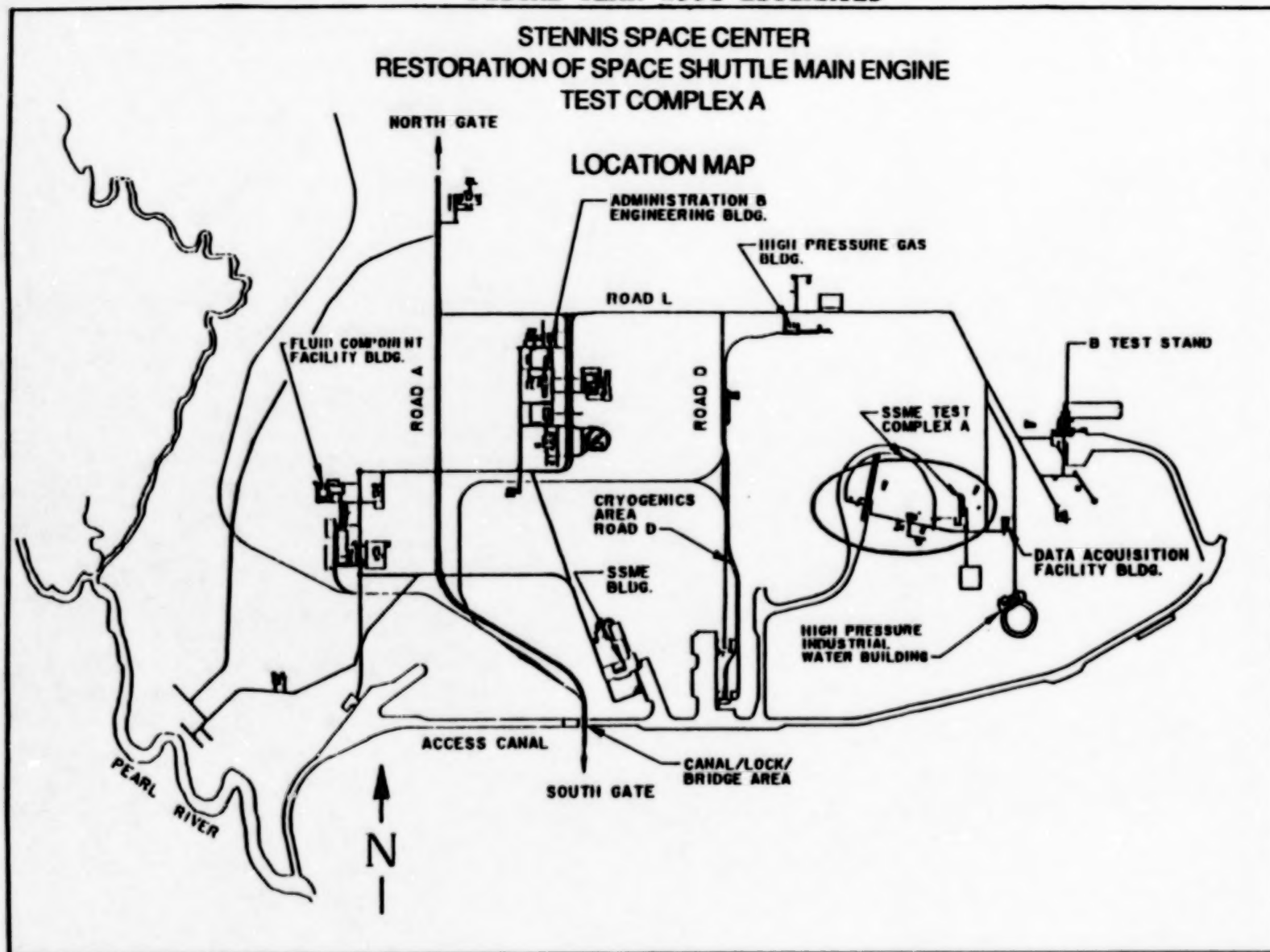


FIGURE 1

FISCAL YEAR 1991 ESTIMATES
STENNIS SPACE CENTER
RESTORATION OF SPACE SHUTTLE MAIN ENGINE
TEST COMPLEX A

SITE PLAN

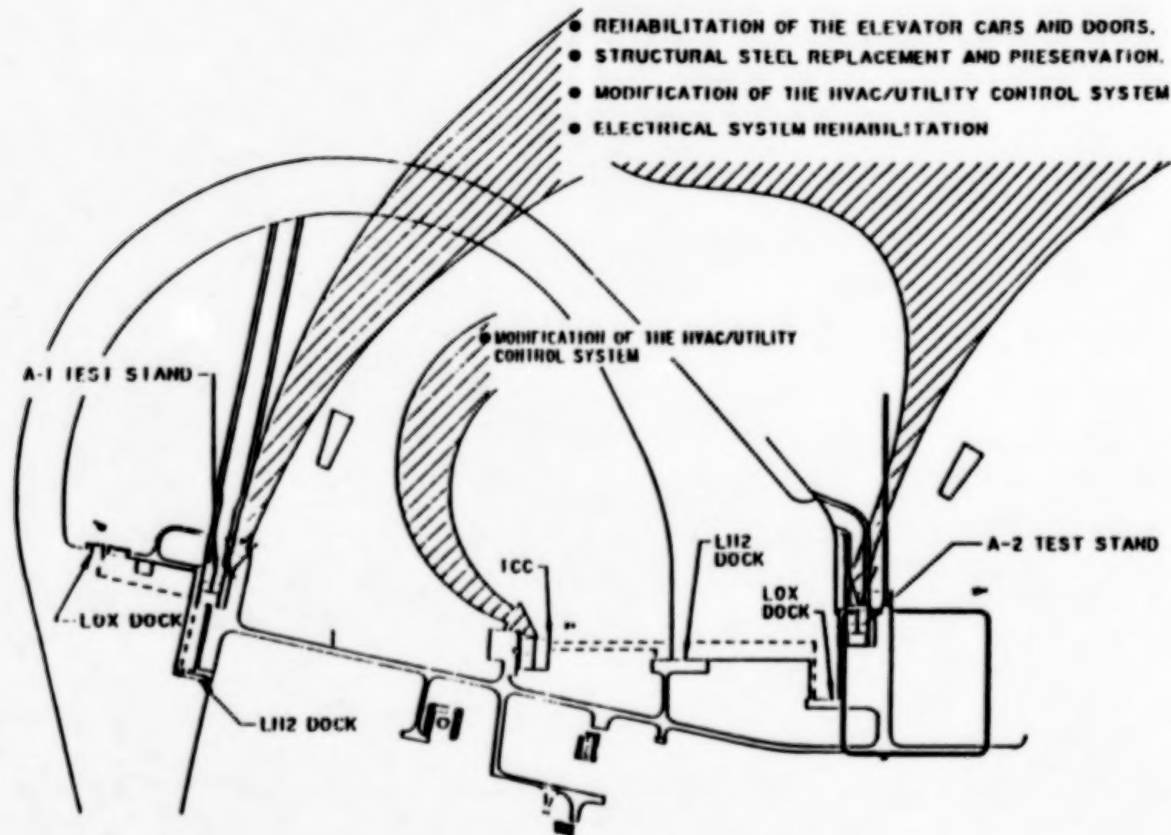


FIGURE 2

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Construction of Advanced Solid Rocket Motor Program Facilities

INSTALLATION: Various Locations

FY 1991 Estimate: \$92,000,000

LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years funding is related to this project:

	<u>Planning, Design and Construction Management</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$21,000,000	\$85,470,000	\$106,470,000
Capitalized Investment.....	---	---	---
Total.....	<u>\$21,000,000</u>	<u>\$85,470,000</u>	<u>\$106,470,000</u>

SUMMARY PURPOSE AND SCOPE:

This continues the construction of Advanced Solid Rocket Motor (ASRM) facility projects, technical support, design, and construction management. ASRM is needed to improve margins of safety and reliability, recover lost payload lift, and add mission capability to the Space Transportation System. The Yellow Creek site in Northeastern Mississippi is the primary site for the production facilities; Stennis Space Center is the site for the testing facilities; and rocket motor handling and assembly facilities modifications are included at the Kennedy Space Center. Additional component manufacturing facilities may be located at other sites as required.

CF 2-78

PROJECT JUSTIFICATION:

The ASRM is required to significantly improve the safety and reliability margins of the Solid Rocket Motor (SRM) and Space Shuttle vehicle by reducing or eliminating more than 200 critical failure modes. It also will provide the Shuttle with a significant gain in performance by providing an additional 12,000 pounds of payload capability. Moreover, development of the ASRM will establish a strong technological foundation upon which the United States leadership in the highly competitive field of solid fueled rockets can be maintained.

Production of the ASRM will require modern and automated facilities with greatly improved manufacturing and quality control processes. The facilities will be designed at a size to support manufacturing of sufficient ASRM flight sets to meet currently-planned Space Shuttle launch rates. The present manufacturing process is labor-intensive with many opportunities for human error and requires excessive inspection efforts to ensure achievement of required standards. The new facilities will incorporate state-of-the-art computer controlled manufacturing and assembly techniques to enhance the reliability and safety margins of the rocket motor, reduce human error and provide more effective inspection techniques.

IMPACT OF DELAY:

Delay of this project will impact the ability of the Space Transportation System to achieve increased reliability and safety margins and increased payload lift.

PROJECT DESCRIPTION:

The total facility construction program is phased over several fiscal years and will include the following major elements of work: site preparation, utilities, manufacturing and production buildings; test facilities; motor handling and assembly facilities; and other support facilities, as required.

The FY 1991 phase of the overall ASRM facility construction program encompasses the following:

Continuation of work for: site preparation including fencing, railroad and parking lots; expansion and extension of existing utilities including raw water, potable water, storm and sanitary sewer, waste treatment, electrical substations and power distribution and communications systems; static test complex including test stand, control building, hydrotest stand, meteorological facility and barge dock; motor propellant mix/cast/cure complex; motor case refurbishment and preparation facility; motor finish facility; non-destructive test facility; nozzle manufacturing complex; production support office; and the initiation of construction for the quality assurance test laboratory; security/medical facility; fire station; warehouse buildings and thermal/pressure test facility.

OTHER EQUIPMENT SUMMARY:

Other equipment to be funded from SFCDC resources is estimated to cost approximately \$250 million, however this amount may change as the program matures.

FUTURE CoF FUNDING REQUIRED TO COMPLETE THIS PROJECT:

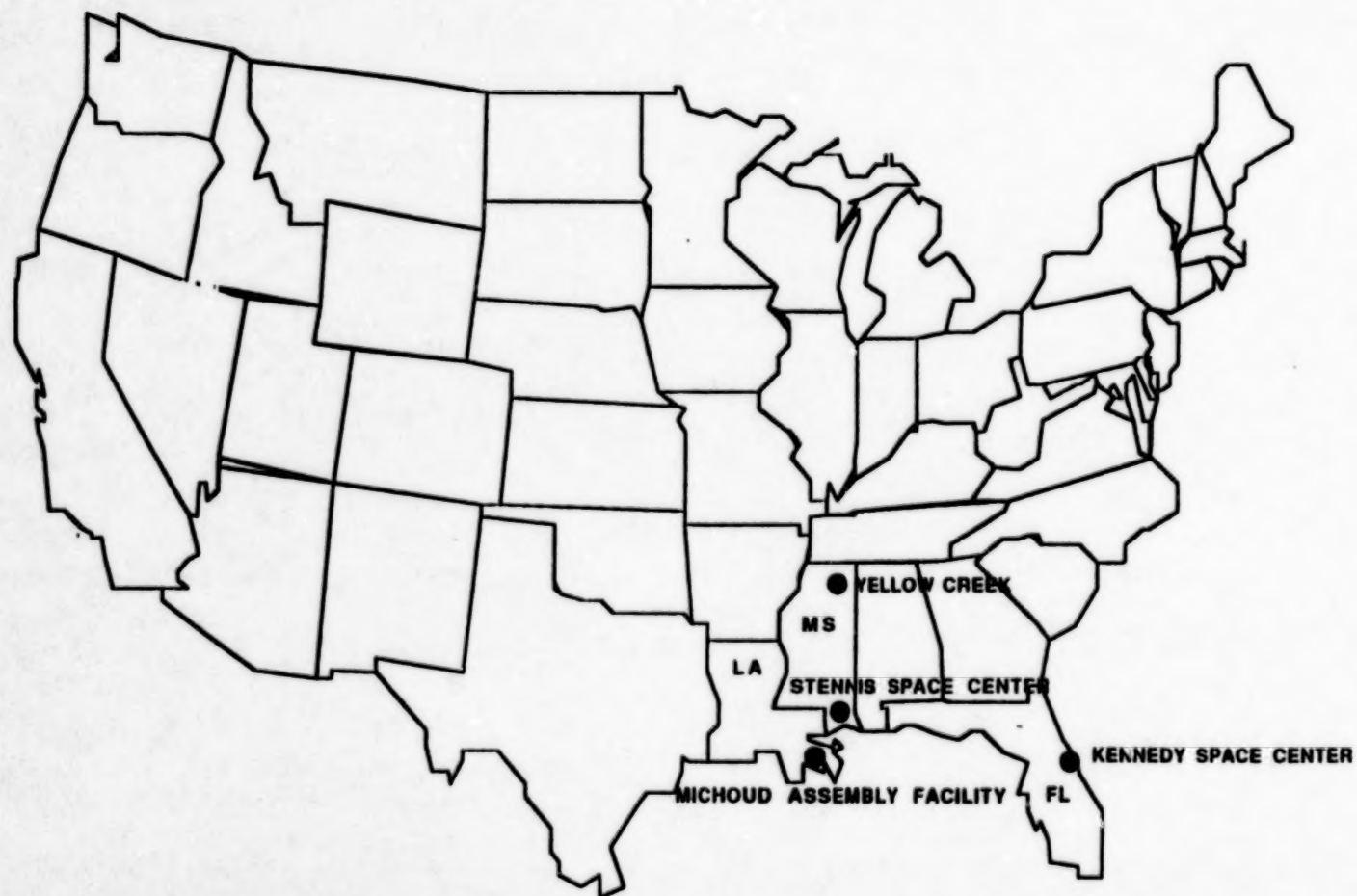
Initial estimated CoF costs for completing ASRM facilities are as shown below:

FY 1992: \$122,600,000 FY 1993: \$5,000,000

Additional KSC operational support facilities that may be required are not included.

**VARIOUS LOCATIONS
FISCAL YEAR 1991 ESTIMATES**

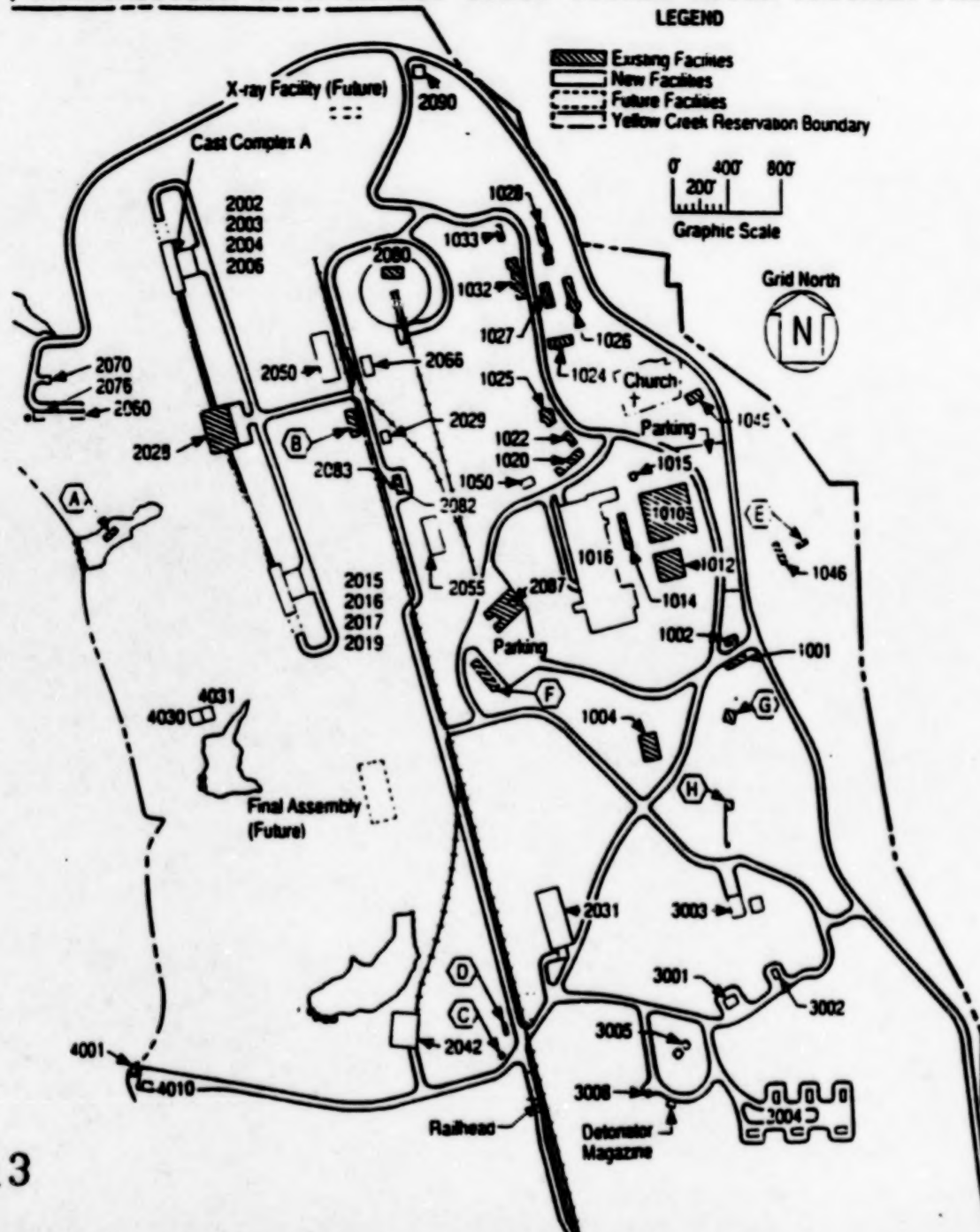
CONSTRUCTION OF ADVANCED SOLID ROCKET MOTOR PROGRAM FACILITIES



PROPOSED MAJOR ASRM WORK LOCATIONS

VARIOUS LOCATIONS
FISCAL YEAR 1991 ESTIMATES

CONSTRUCTION OF ADVANCED SOLID ROCKET MOTOR PROGRAM FACILITIES



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

SUMMARY

JOHNSON SPACE CENTER

<u>Office of Space Flight:</u>	<u>Amount</u>	<u>Page</u>
	<u>(Dollars)</u>	<u>No.</u>
Construction of Addition to Site Electrical Substation.....	11,000,000	CF 3-1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Construction of Addition to Site Electrical Substation

INSTALLATION: Lyndon B. Johnson Space Center

FY 1991 CoF Estimate: \$11,000,000

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project.

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF funding.....	\$895,000	---	\$ 895,000
Capitalized investment.....	---	<u>\$2,881,576</u>	<u>2,881,576</u>
Total.....	<u>\$895,000</u>	<u>\$2,881,576</u>	<u>\$3,776,575</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the addition of one substation transformer, two switchgear lineups, and new duct banks for the site electrical distribution system. New 138-kilovolt (kV) ring bus gas circuit breakers will be installed to accommodate these additions. The existing control room will be expanded to house the additional controls. This expansion will enable the Johnson Space Center (JSC) to provide adequate electric power for planned facility construction through FY 1995.

CF 3-1

PROJECT JUSTIFICATION:

The main site substation was constructed with a redundant transformer/switchgear bus configuration with an operating capacity of 33,000 kilowatt (kW) which can increase to an emergency load limit of 42,000 kW. At present, the total power at JSC is held to 30,000 kW by load shedding so that equipment is not overloaded. New facility construction planned at JSC plus an annual 1-percent load growth of building electrical and air-conditioning loads will increase the load on the substation to 43,000 kW by the fourth quarter of FY 1992. Further anticipated growth will increase the load to 50,000 kW in FY 1995. This project must be completed to meet the projected load growth. This planned addition to the substation will meet the needs of JSC through FY 1995.

IMPACT OF DELAY:

If this project is not approved, restrictions on the operation of existing facilities will become more severe. Operation of new facilities and equipment will have to be curtailed, and JSC would not be able to operate at 100 percent. The frequency and magnitude of load shedding will escalate and the added load will accelerate the deterioration of the main substation transformers. This will increase the possibility of a total Center "blackout."

PROJECT DESCRIPTION:

This project provides for the upgrading and expansion of the main site substation, building 221. The project modifies the existing ring bus structure to permit the installation of two 138-kV gas circuit breakers, twelve 138-kV manually operated disconnect switches, and one substation transformer rated 25/33/42 MVA at 138-kV/12.4kV with automatic load-tap changer and associated grounding resistor. The additional power will be distributed by two 12.47-kV switchgear lineups which will be housed in two new switchgear buildings. The existing substation control room will be expanded to provide for new transformer paralleling controls, the utility control system (UCS) interface, new utility (power company) metering, Supervisory Control and Data Acquisition (SCADA) system equipment, additional ring bus breaker controllers, and new high voltage transmission line relays, and a maintenance shop. The substation fence will be relocated and the grounding system expanded.

New duct banks will be installed and will include six new 12.47-kV distribution feeders. Existing feeders will be relocated.

PROJECT COST ESTIMATE: Based on criteria and concepts only.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$11,000,000</u>
Demolish Concrete Slab, Install				
Gravel, etc.....	SF	27,000	\$ 7.04	\$ 190,000
Control Building.....	SF	2,000	134.00	268,000
Duct Bank with Concrete Encasement.....	LF	6,200	391.61	2,428,000
15-kV Power Feeder.....	LF	66,667	24.94	1,662,500
138-kV Power Transformer.....	EA	1	---	1,081,000
Metal-clad Switchgear.....	EA	2	755,000	1,510,000
Switchgear Tie Busses.....	LF	819	1,378.51	1,129,000
Miscellaneous Electrical Work.....	LS	---	---	2,731,500
Total.....				<u>\$11,000,000</u>

LIST OF RELATED GRAPHICS:

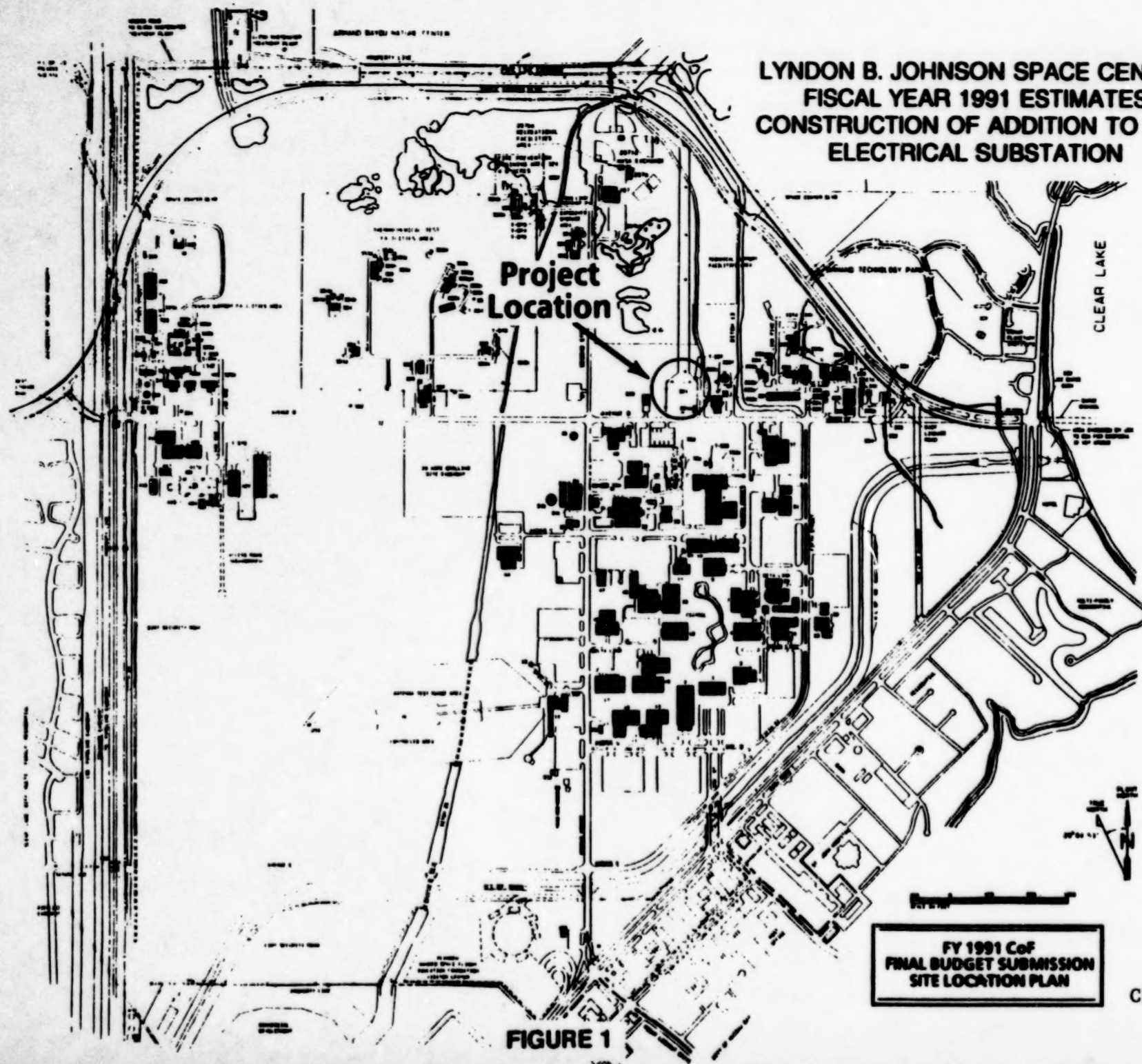
Figure 1 - Location Plan Figure 2 - Perspective

OTHER EQUIPMENT SUMMARY: None

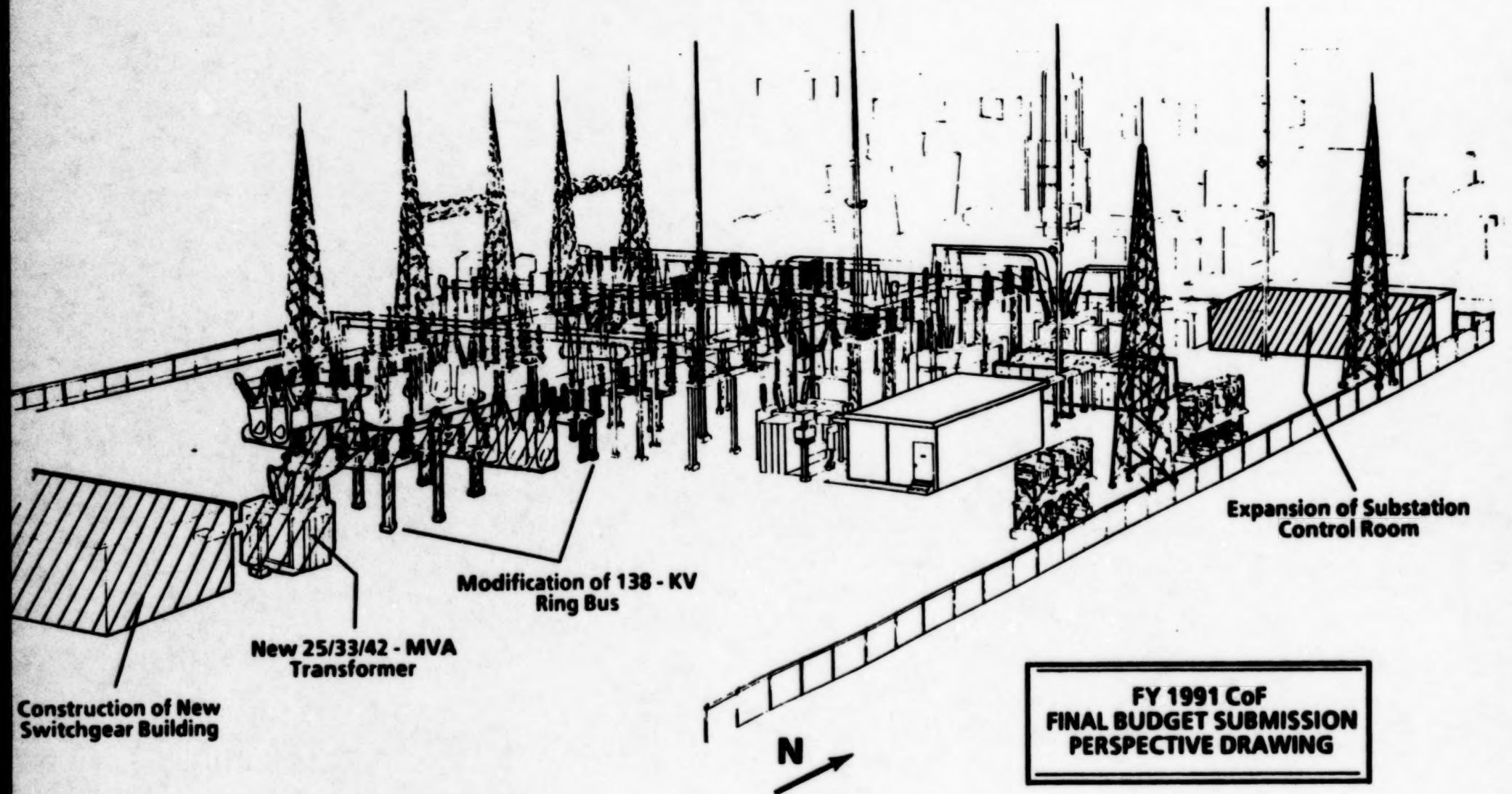
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Further expansion of this substation will be required as additional facilities are approved and added to the system.

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF ADDITION TO SITE
ELECTRICAL SUBSTATION



LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF ADDITION TO SITE ELECTRICAL SUBSTATION



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

SUMMARY

STENNIS SPACE CENTER

	Amount	Page No.
	-----	-----
	(Dollars)	
Office of Space Flight:		

Addition to Administration and Engineering Building	3,800,000	CF 4-1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Addition to the Administration and Engineering Building

INSTALLATION: John C. Stennis Space Center

FY 1991 CoF Estimate: \$3,800,000

LOCATION OF PROJECT: Stennis Space Center, Hancock County, Mississippi

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$260,000	\$ ---	\$ 260,000
Capitalized Investment.....	---	<u>5,144,389</u>	<u>5,144,389</u>
Total.....	<u>\$260,000</u>	<u>\$5,144,389</u>	<u>\$5,404,389</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of a 45,000-square-foot addition to the Administration and Engineering Building 1100. In the last ten years the workforce at Stennis Space Center (SSC) has more than quadrupled. It is anticipated that the number of civil service and support contractor personnel will continue to increase to adequately support advance propulsion systems and other NASA programs. During these years there has been no additional office and technical workspace provided for NASA personnel. This addition to the main engineering building is necessary to accommodate current and future increases in personnel associated with these programs. Currently all permanent office and technical space is fully utilized and civil service and contractor personnel are located in inadequate and temporary facilities.

CF 4-1

PROJECT JUSTIFICATION:

Stennis Space Center (SSC) is assigned the role of advanced development and production testing for advanced engine components and the development and production testing for the Advanced Solid Rocket Motor (ASRM) boosters. These programs will extend into the mid 1990's and beyond, they will require additional permanent office and technical space to accommodate the increased number of administrative and engineering personnel required for program support. In addition, 330 personnel are presently housed in substandard office facilities including modified warehouse space, trailers and temporary buildings. New programs at SSC will require the addition of 150 civil service and 262 contractor personnel by the year 1992. The construction of a centrally located and modern facility will help minimize maintenance and operating costs as well as increase morale and efficiency of the workforce.

IMPACT OF DELAY:

If this project is not approved, approximately 50 trailers, or the lease of an equivalent amount of off-site office space, will be required to provide temporary facilities for the increasing number of staff for advanced propulsion support.

PROJECT DESCRIPTION:

This project provides for the addition to the Administration and Engineering Building (1100) to include a three story addition at the north end of the existing building. This will increase the existing facility area by 45,000-square-feet and will include office, technical and computer space, mechanical and electrical rooms, communications and rest rooms. This structure will consist of a pile foundation, concrete slabs, steel frame superstructure, exterior envelope of precast concrete panels and fenestration similar architecturally to existing Building 1100. Interior finishes will be gypsum wallboard on metal studs, demountable partitions, ceramic tiled rest rooms, vinyl tile flooring in high traffic areas and acoustical ceilings. Required mechanical and electrical support systems are included.

PROJECT COST ESTIMATE: Based upon a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$3,800,000</u>
Site Development.....	LS	---	23,000	23,000
Foundation.....	SF	17,000	26	439,000
Substructure and Exterior Walls.....	LS	---	792,000	842,000
Roofing.....	LS	17,000	4	72,000
Finishes.....	LS	---	676,000	676,000
Mechanical.....	LS	---	864,000	864,000
Electrical.....	LS	---	688,000	688,000
Specialities.....	LS	---	196,000	<u>196,000</u>
 Total.....				 <u>\$3,800,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - SSC Location Map Figure 2 - Concept

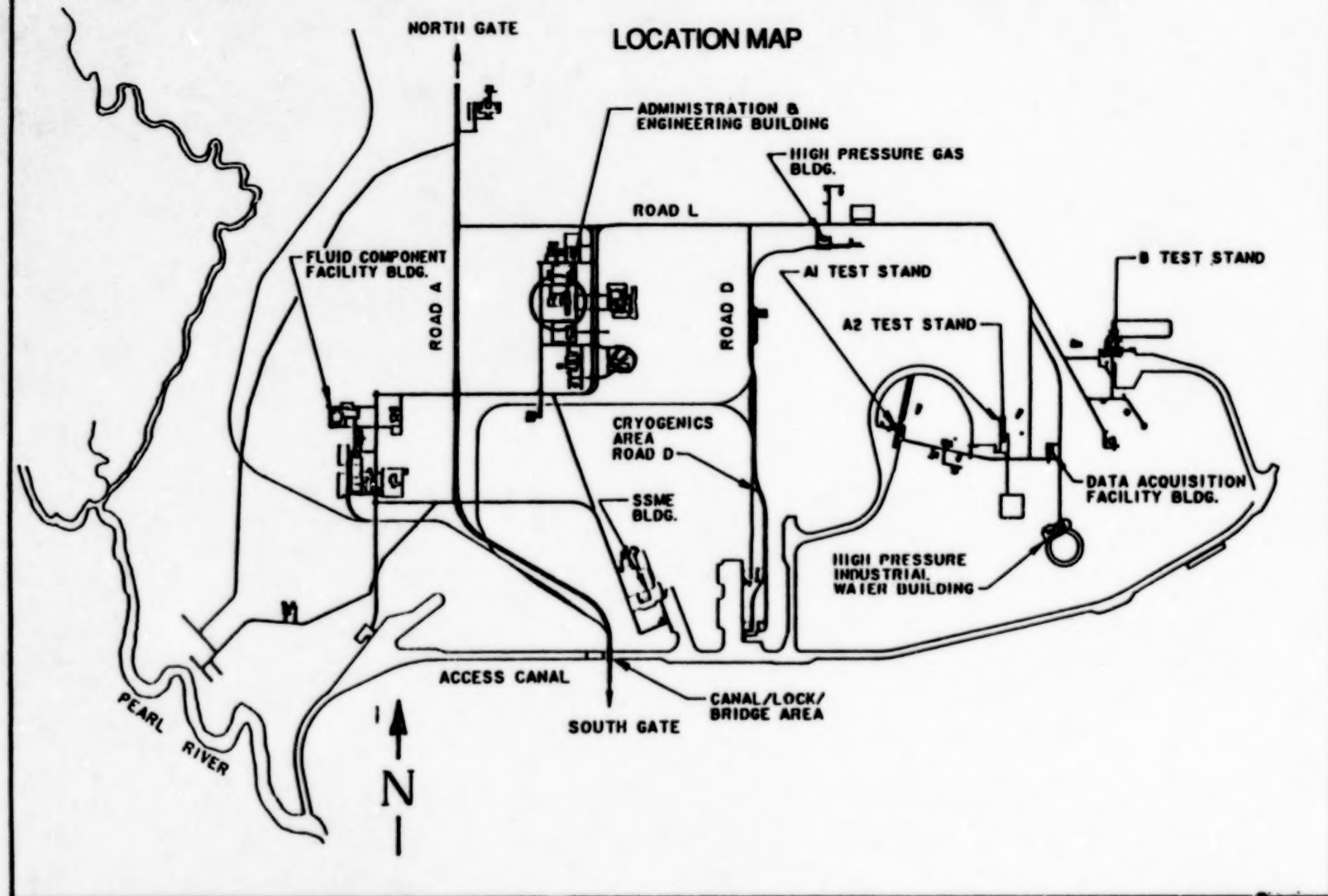
OTHER EQUIPMENT SUMMARY:

Procurement of \$2 million of non-collateral equipment to meet data communication requirements.

FUTURE CoF FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

FISCAL YEAR 1991 ESTIMATES

STENNIS SPACE CENTER
ADDITION TO ADMINISTRATION AND ENGINEERING BUILDING (1100)

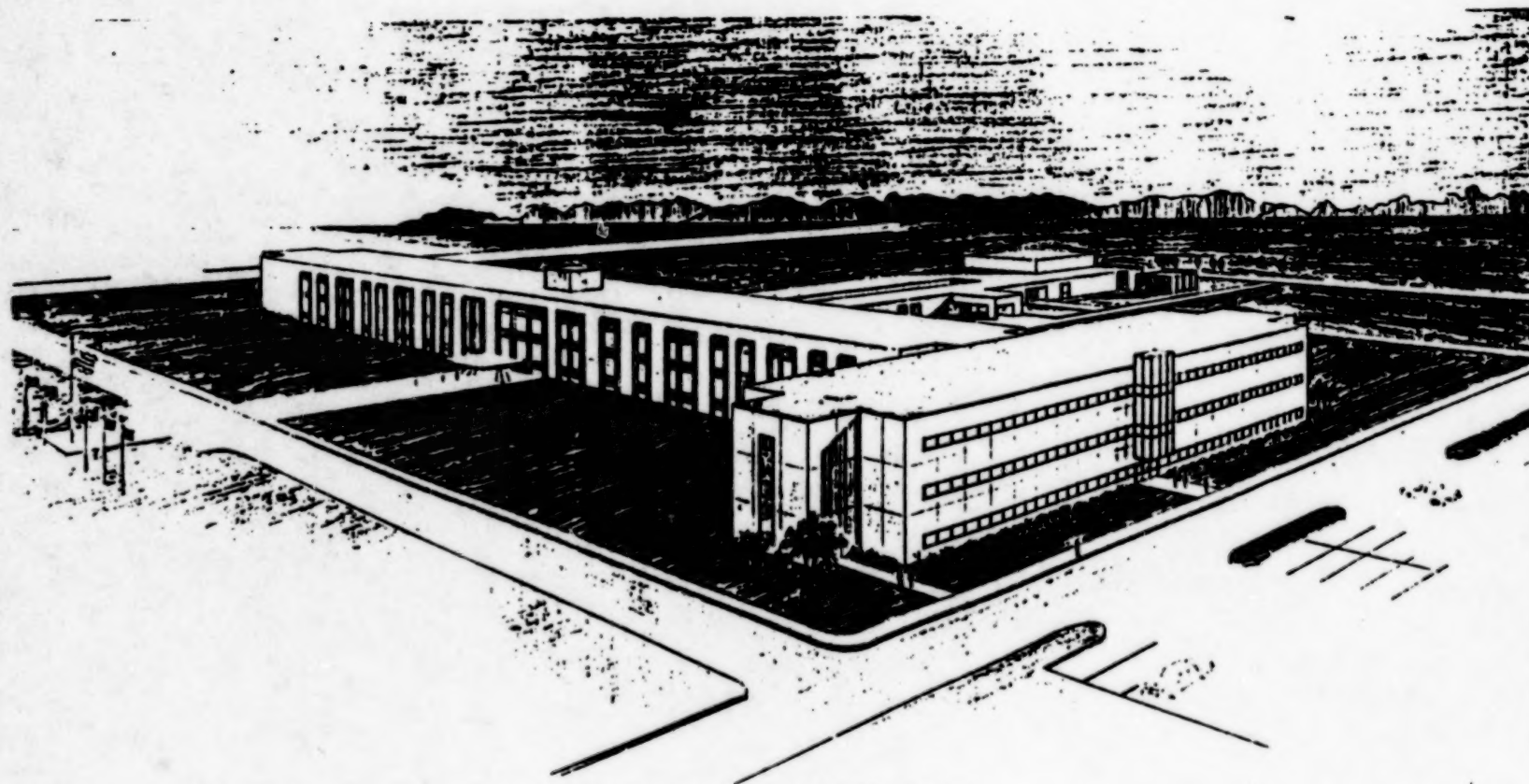


CF 4-4

FIGURE 1

FISCAL YEAR 1991 ESTIMATES
STENNIS SPACE CENTER
ADDITION TO ADMINISTRATION AND ENGINEERING BUILDING (1100)

CONCEPT



CF 4-5

FIGURE 2

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

SUMMARY

GODDARD SPACE FLIGHT CENTER

	Amount	Page
	(Dollars)	No.
Office of Space Science and Applications:		
Construct Earth Observing System Data Information System Facility....	8,000,000	CF 5-1
Construction of Detector Development Laboratory.	3,100,000	CF 5-6
Replace Chillers, Central Heating/Refrigeration Plant.....	4,000,000	CF 5-12
Replacement/Modernization Electrical Power Feeders.....	1,500,000	CF 5-18
Total.....	16,600,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Construct Earth Observing System Data Information System Facility

INSTALLATION: Goddard Space Flight Center Center

FY 1991 CoF Estimate: \$8,000,000

LOCATION OF PROJECT: Greenbelt, Prince George's County, Maryland

COGNIZANT HEADQUARTERS OFFICE: Office of Space Science and Applications

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project.

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF funding.....	\$3,650,000	---	\$3,650,000
Capitalized investment.....	---	---	---
Total.....	<u>\$3,650,000</u>	<u>---</u>	<u>\$3,650,000</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the first increment of construction of a Earth Observing System Data Information System (EosDIS) facility at the Goddard Space Flight Center. The facility will provide a total of approximately 190,000 square feet of space to house automatic data processing equipment (ADPE), and scientific, administrative, and support personnel required to maintain a processing, archiving and distribution capability in support of the Eos Program. The second and third increments to complete the facility are planned for FY 1992 and FY 1993.

CF 5-1

PROJECT JUSTIFICATION:

The Earth Observing System (Eos) program anticipates the cooperative involvement of the United States, the European Space Agency (ESA), and the Japanese National Space Development Agency (NASDA). The United States' portion of the program will be implemented by NASA in cooperation with the National Oceanic and Atmospheric Administration (NOAA). The Eos program will support observation of the Earth from space using unmanned platforms. These platforms will be equipped with remote sensing instruments and will be launched into a polar orbit to facilitate viewing of all parts of the globe. The measurements obtained from these observations will constitute a 15 year data set, which will be used by scientists to construct and test models and theories about global environmental interactions. Information resulting from the Eos Program will contribute to an understanding of the consequences of human activity on the environment, and aid in predicting the impact of man-made and natural environmental events. This information will provide world leaders and policy makers with the information needed to make timely and informed decisions which will help to preserve the habitability of the global ecosystem. Currently no facility or system exists within NASA or the world scientific community that is capable of supporting the data processing and storage requirements of EOS. Construction of a new facility for the EosDIS is the only viable alternative for providing the required level of Eos support. The magnitude of the facilities requirement precludes the recovery and reuse of existing GSFC space, and the costs and inefficiencies associated with leasing off-Center space for a program of this magnitude and longevity would be excessive.

A Beneficial Occupancy Date (BOD) of March 1994 has been identified for the EosDIS facility. Completion of the facility is required in this timeframe to support the installation of associated ADP equipment, and subsequent component software development, installation, debugging, and Data Operations System (DOS)/Eos interface testing prior to launch of the first space platform in mid 1997. In addition, the facility is required to support end-to-end integration, and integration of space platform instruments, as well as operational training prior to the pre-launch freeze for the first space platform launch.

IMPACT OF DELAY:

If construction of the EosDIS facility is delayed, it will adversely impact the polar platform program.

PROJECT DESCRIPTION:

This project will provide the initial increment of construction for the 190,000-square-foot facility located east of Soil Conservation Service Road and north of Greenbelt Road. Site development work to include primary electrical service, communications duct bank, access roads, chiller plant, chilled water distribution and domestic wastes, sanitary, storm sewer, steam system will be emphasized during this phase of work.

Functional areas for this facility include: 1) 75,000-square-foot Central Data Handling Facility, 2) 55,000-square-foot Information Management Center, and 3) 60,000-square-foot Data Archiving/Distribution Area.

The facility will consist of a combination multi-story steel and concrete structure. Exterior finish materials will consist of masonry, glass and aluminum, and/or precast concrete panels, in keeping with materials used elsewhere on Center. Interior finishes include raised flooring in ADPE area, heating, ventilation, and air conditioning systems, fire protection and detection systems. Interior and exterior lighting, electrical power, building security systems and a uninterruptible plant system will be provided. Necessary provisions for domestic water, sanitary sewer, steam, and telephone and communications duct banks will also be provided. Construction of access roads, necessary parking, sidewalks, curbs and gutters, site lighting, landscaping, security fencing, electrical substation, and chilled water plant are also included.

PROJECT COST ESTIMATE: Based upon a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$8,000,000</u>
Primary Electrical.....	LS	---	---	1,500,000
Communications Duct Bank.....	LS	---	---	1,000,000
Chilled Water Plant.....	LS	---	---	3,300,000
Domestic Water, Sewer, Storm, Steam Systems.....	LS	---	---	800,000
Roads.....	LS	---	---	1,400,000
Total.....				<u>\$8,000,000</u>

Note: This cost estimate provides for the FY 1991 increment of the total facility. The total cost of the project is estimated to be approximately \$42,000,000.

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan

OTHER EQUIPMENT SUMMARY:

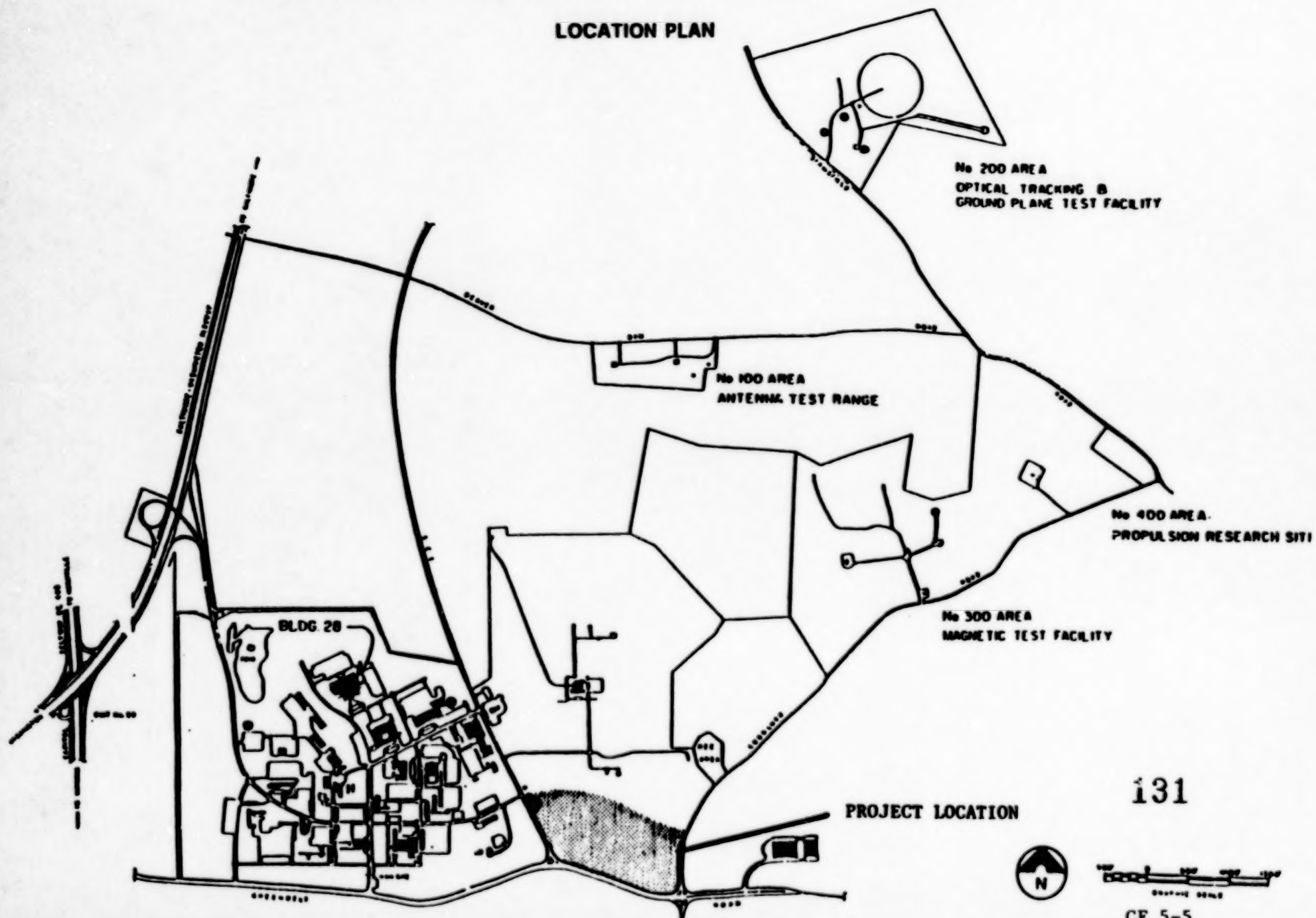
Approximately \$100,000,000 of R&D funded ADPE to support data processing, information management and data archiving requirements will be required for this facility.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

To complete this project, a second increment will be included in the FY 1992 budget request at \$17,000,000 and a third increment in the FY 1993 budget at \$17,000,000.

**GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCT EARTH OBSERVING SYSTEM DATA INFORMATION SYSTEM FACILITY**

LOCATION PLAN



131

CF 5-5

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Construction of Detector Development Laboratory

INSTALLATION: Goddard Space Flight Center

FY 1991 CoF Estimate: \$3,100,000

LOCATION OF PROJECT: Greenbelt, Prince George's County, Maryland

COGNIZANT HEADQUARTERS OFFICE: Office of Space Science and Applications

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$660,000	\$4,540,000	\$5,200,000
Capitalized Investment.....	---	<u>3,641,615</u>	<u>3,641,615</u>
Total.....	<u>\$660,000</u>	<u>\$8,181,615</u>	<u>\$8,841,615</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of a two-level, 18,000 square feet technical laboratory to house the Detector Development Laboratory (DDL) hazardous operations. The mission of the DDL has required increased use of hazardous materials and processes to the extent that it has become critical to move activities to a separate laboratory specifically constructed to accommodate hazardous functions. Budgetary constraints in FY 1990 did not permit the construction of this laboratory as originally planned.

CF 5-6

PROJECT JUSTIFICATION:

The Goddard Space Flight Center (GSFC) is responsible for the development and management of unmanned science and applications earth orbiting satellites, Shuttle attached payloads and Space Station modules and platforms. These mission responsibilities include flight materials selection, control, verification and other materials quality assurance related activities; and the design, development and fabrication of advanced semiconductor microelectronic detectors to support specific mission requirements. These activities are supported by the DDL. Presently this laboratory is collocated with offices and other non-hazardous functions in the Applied Sciences Laboratory, Building 11. Despite strict adherence to safety procedures, it is now critical for continued safe operations to move this function to a separate facility.

Semiconductor fabrication in the DDL requires various hazardous processing steps including the use of poisonous gases, poisonous chemicals and low-level radiation. The new facility would house all of the hazardous processes to eliminate the risk of contamination to other working spaces by laboratory mishaps.

IMPACT OF DELAY:

Delay in construction of this project would continue to subject approximately 300 occupants in Building 11 to unnecessary potential health and safety risks associated with laboratory mishaps. In addition, materials assurance support activities and the development of advanced electronics would be severely impacted.

PROJECT DESCRIPTION:

This project will provide for a 18,000 square foot two-level brick and block addition to house DDL requirements. The addition will be connected to the south wall of existing Building 11 and the north wall of the Materials Quality Assurance Laboratory. The DDL will be located on the main operating level. It will be physically separated by a 4-hour fire rated concrete masonry wall. A gowning/support area (1,200 square feet) will serve as the "link" between the existing Building 11 and the entrance to the DDL in the new facility. The DDL area, (8,400 square feet) will be vibration-controlled. A class 100 laminar flow clean room within a class 10,000 clean room will be provided. The supporting lower level (8,400 square feet) will be used to house process support equipment, building utility systems, chemical storage and other miscellaneous support functions. Electric power, communications, chilled water, steam, domestic water, gas, storm drain, and sanitary sewer, will be extended from existing center systems to support this facility.

PROJECT COST ESTIMATE: Based on a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$3,100,000</u>
Site Development.....	LS	---	---	150,000
Architectural.....	SF	18,000	22.22	400,000
Structural.....	SF	18,000	27.77	500,000
Mechanical.....	SF	18,000	63.88	1,150,000
Electrical.....	SF	18,000	50.00	900,000
 Total.....				 <u>\$3,100,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Project Location Figure 2 - Site Plan Figure 3 - Longitudinal Section

OTHER EQUIPMENT SUMMARY:

Laboratory equipment estimated to cost \$4,000,000 will be provided from Research and Development funds.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None anticipated at this time.

**GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF DETECTOR DEVELOPMENT LABORATORY
LOCATION PLAN**

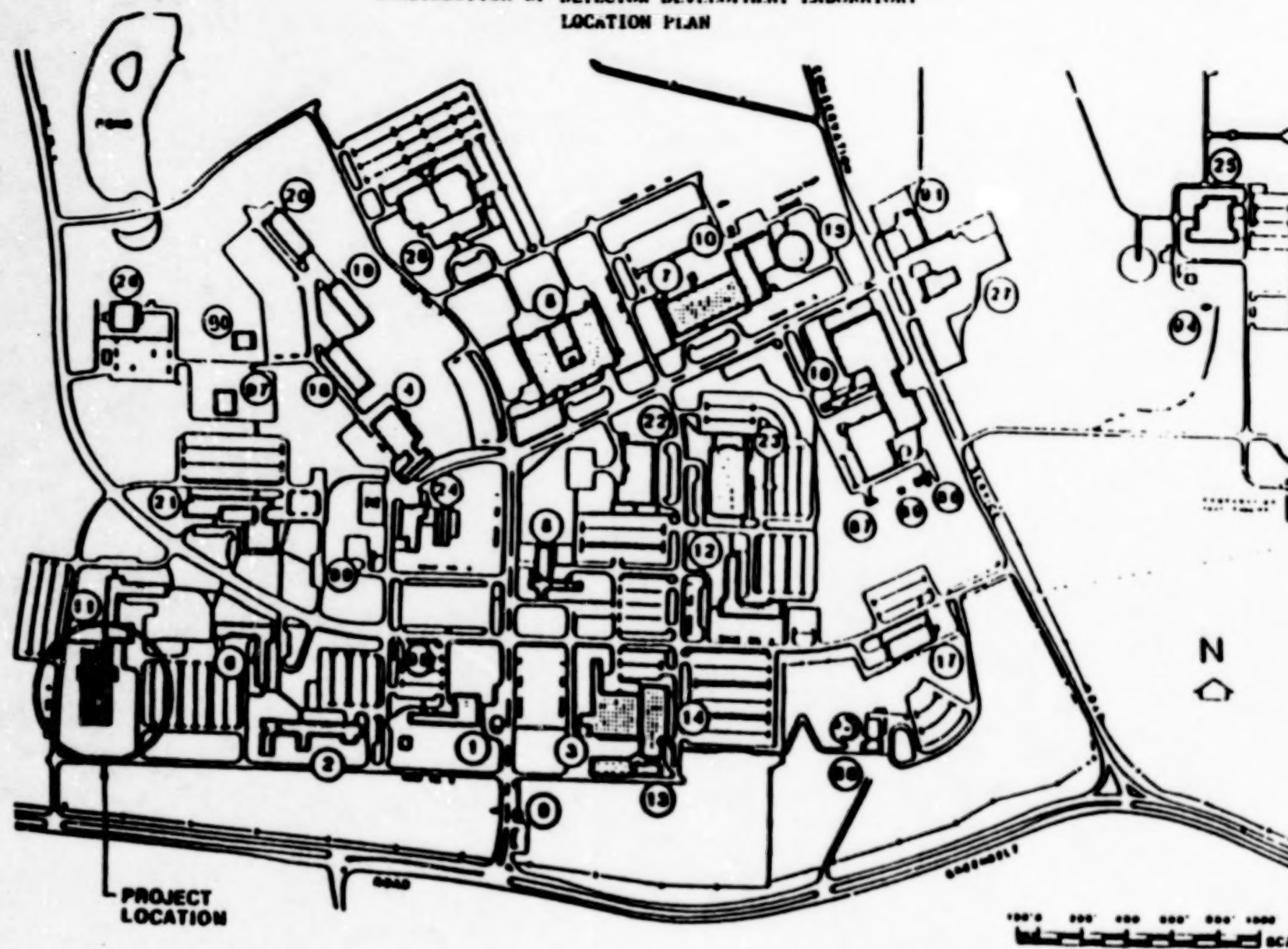


FIGURE 1

CF 5-9

CUBBER SPACE FLIGHT CENTER
 FISCAL YEAR 1991 ESTIMATES
 CONSTRUCTION OF DETECTOR DEVELOPMENT LABORATORY
 SITE PLAN

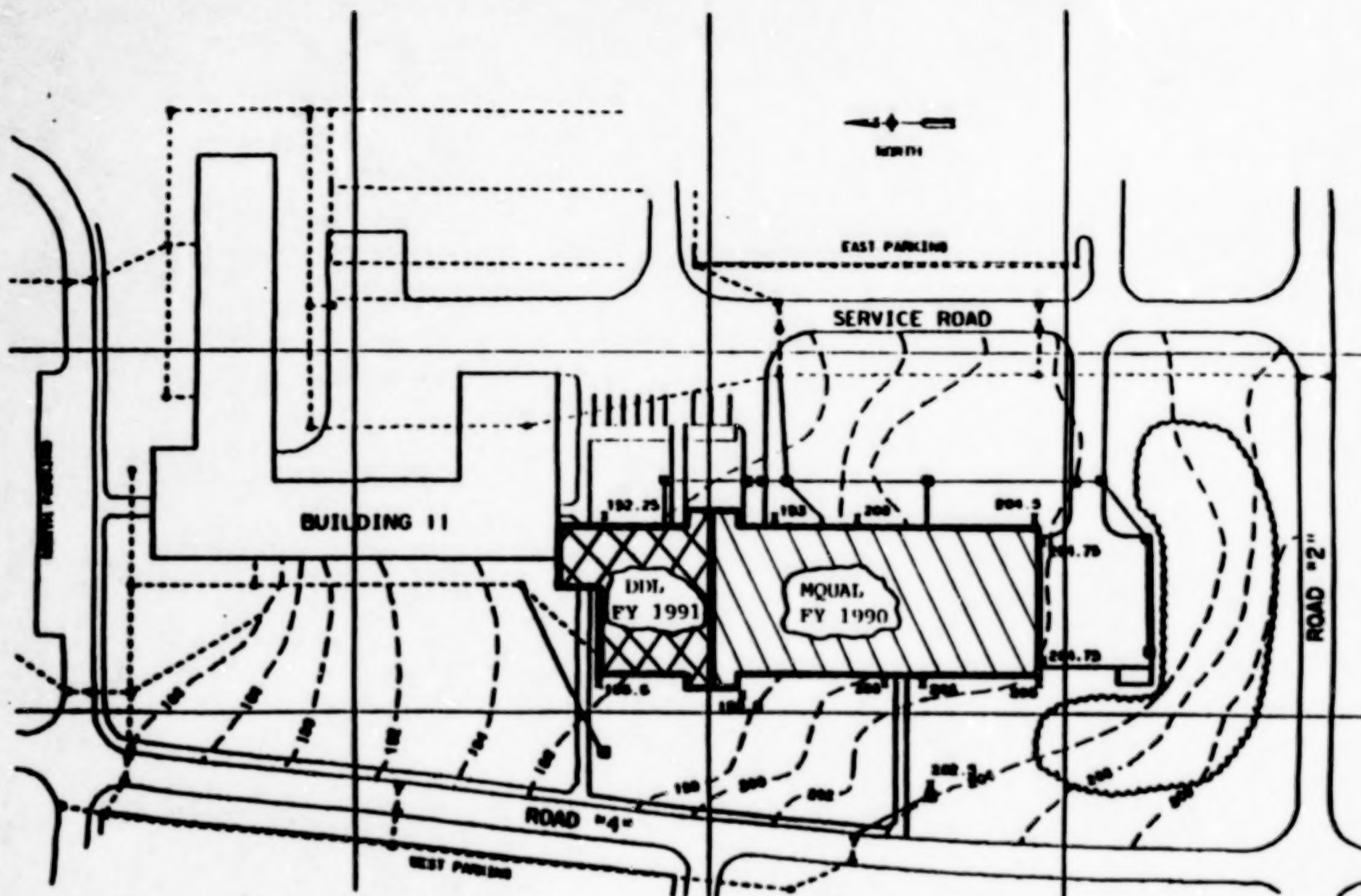


FIGURE 2

CF 5-10

**COBBARD SPACE FLIGHT CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF DETECTOR DEVELOPMENT LABORATORY
LONGITUDINAL SECTION**



FIGURE 3

CF 5-11

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Replace Chillers, Central Heating/Refrigeration Plant

INSTALLATION: Goddard Space Flight Center

FY 1991 CoF Estimate: \$4,000,000

LOCATION OF PROJECT: Greenbelt, Prince George's County, Maryland

COGNIZANT HEADQUARTERS OFFICE: Office of Space Science and Applications

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$365,000	---	\$ 365,000
Capitalized Investment.....	---	<u>\$2,105,802</u>	<u>2,105,802</u>
Total.....	<u>\$365,000</u>	<u>\$2,105,802</u>	<u>\$2,470,802</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for restoring and modernizing the refrigeration plant capability by replacing three 2,000-ton refrigeration systems with 7,500 tons of refrigeration equipment capacity with economizers, including replacement of switchgear, feeders, chilled water pumps, controls, piping, valving, and ancillary equipment.

PROJECT JUSTIFICATION:

The existing Central Heating and Refrigeration Plant (Building 24) houses the steam boilers, water chillers and emergency generator for the Goddard Space Flight Center (GSFC). Presently, the reliable plant cooling capacity is 9,000 tons which equals the existing peak cooling requirement. Projected planned growth of the facility's peak load will increase to approximately 10,500 tons of refrigeration thereby overloading the plant.

Although three of the six chillers are in excellent operating condition, the other three are more than 20 years old and are at the end of their useful life and perform below average generating efficiency. Replacement parts are difficult to obtain for these old chillers. The proposed replacement of these chillers will restore refrigeration plant reliability and overall performance as well as reduce maintenance costs and equipment downtime. Increasing the capability of the replacement equipment to 7,500 tons will also increase the plant capacity to 10,500 tons, the projected peak cooling requirement.

IMPACT OF DELAY:

Delay of this project will increase the probability and degree of impact due to a chiller failure. Failure of a single chiller during a peak load period will reduce plant capacity below acceptable levels and would require prolonged shedding of load until completion of repairs could be made.

PROJECT DESCRIPTION:

This project provides for the replacement of three electric-driven 2000-ton centrifugal water chillers (designated as Chillers 5, 6, and 7). The existing chillers are located in the Central Heating and Refrigeration Plant, Building 24, and are to be replaced in their entirety, including pumps, controls, valving, switchgear and feeders with three new high efficiency centrifugal chillers each at a 2,500-ton capacity.

PROJECT COST ESTIMATE: Based on a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$4,000,000</u>
Mechanical.....	LS	---	---	3,700,000
Electrical.....	LS	---	---	300,000
<u>Equipment</u>	---	---	---	---
Total.....				<u>\$4,000,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan; Figure 2 - Building 24 Floor Plan; Figure 3 - Building 24, South Chiller Room Layout

OTHER EQUIPMENT SUMMARY:

No other equipment is required to complete this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project.

PROJECT COST ESTIMATE: Based on a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$4,000,000</u>
Mechanical.....	LS	---	---	3,700,000
Electrical.....	LS	---	---	300,000
<u>Equipment</u>	---	---	---	---
Total.....				<u>\$4,000,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan; Figure 2 - Building 24 Floor Plan; Figure 3 - Building 24, South Chiller Room Layout

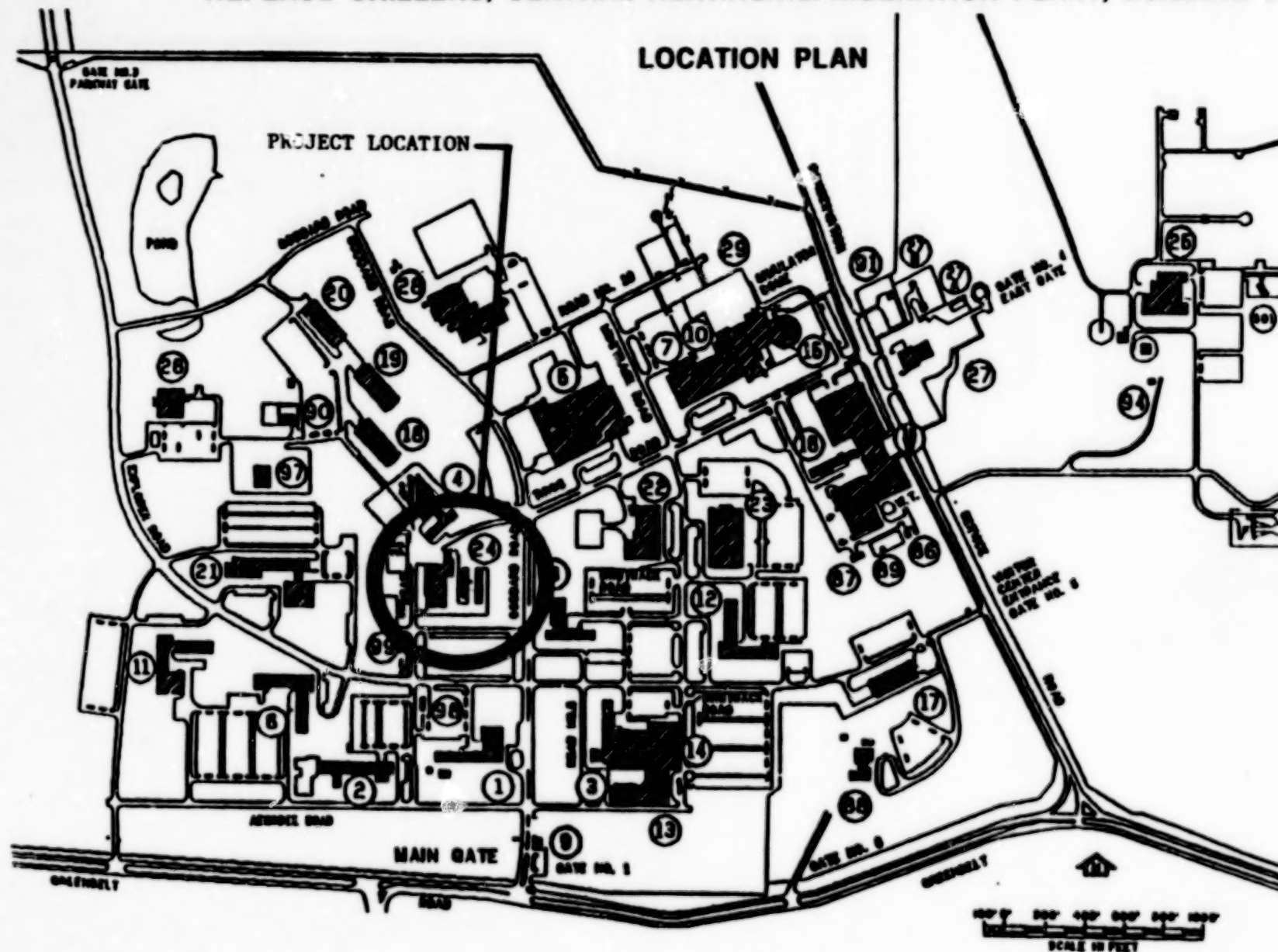
OTHER EQUIPMENT SUMMARY:

No other equipment is required to complete this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

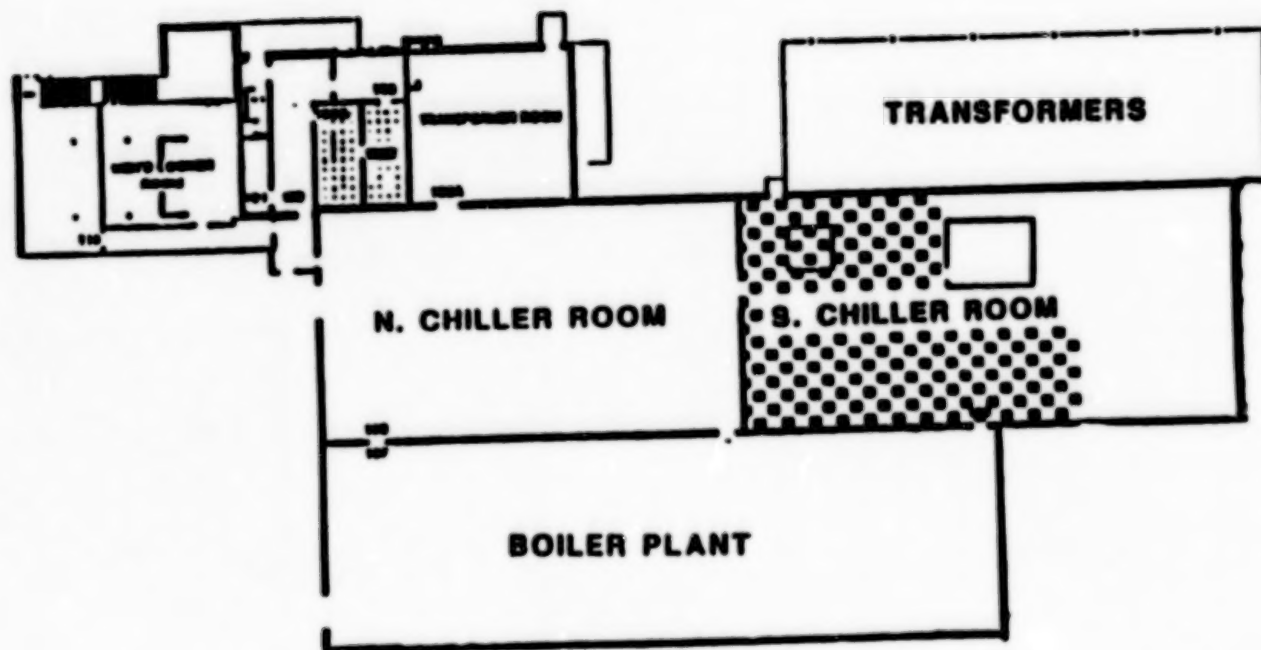
No future CoF funding is required to complete this project.

**GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1991 ESTIMATES
REPLACE CHILLERS, CENTRAL HEATING/REFRIGERATION PLANT, BUILDING 24**



**GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1991 ESTIMATES
REPLACE CHILLERS, CENTRAL HEATING/REFRIGERATION PLANT, BUILDING 24**

BUILDING FLOOR PLAN



PROJECT LOCATION

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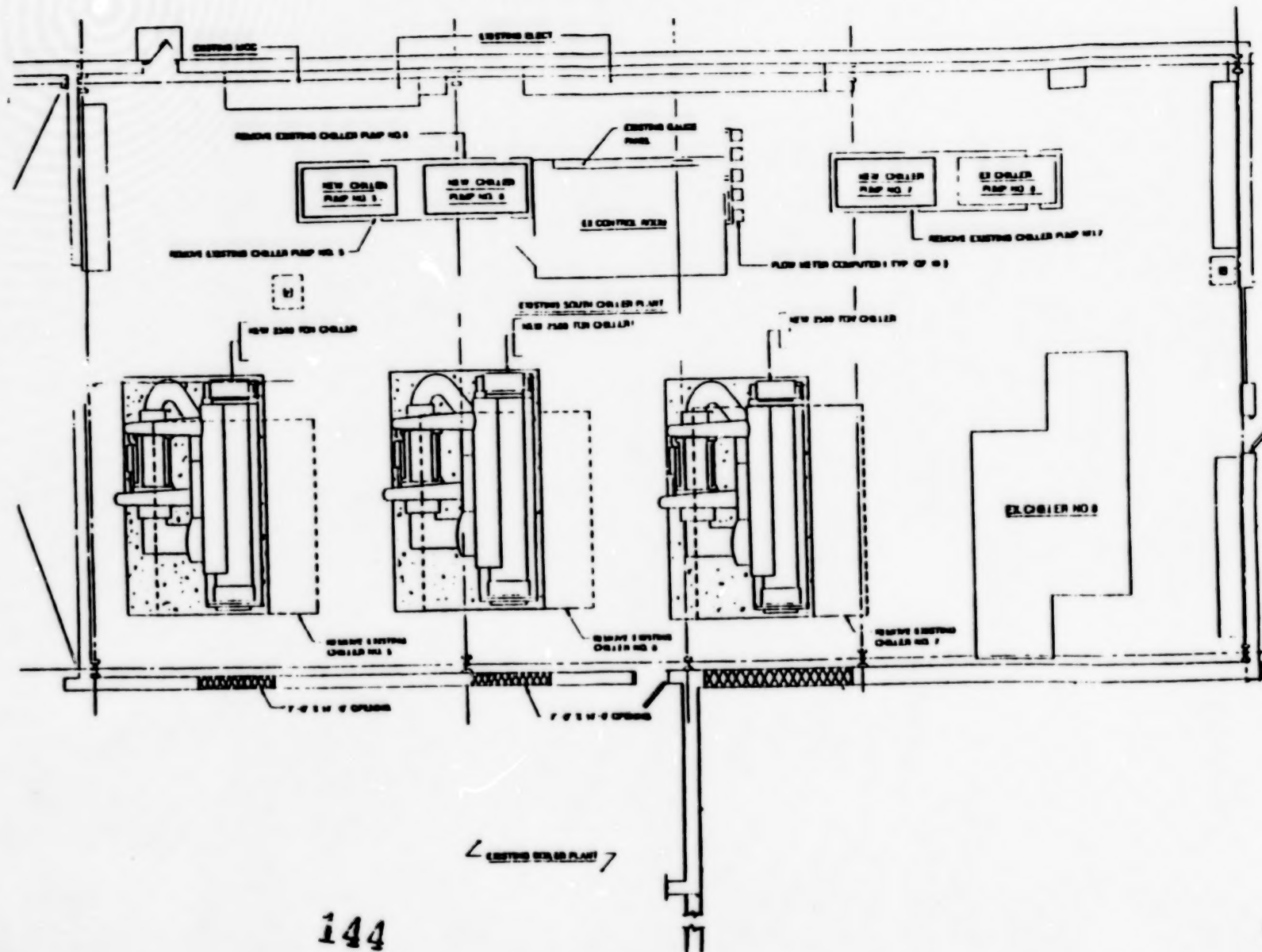
FIGURE 2

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PAGE

**GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1991 ESTIMATES
REPLACE CHILLERS, CENTRAL HEATING/REFRIGERATION PLANT, BUILDING 24**

SOUTH CHILLER ROOM LAYOUT



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CF 5-17

FIGURE 3

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Replacement/Modernization Electrical Power Feeders

INSTALLATION: Goddard Space Flight Center

FY 1991 CoF Estimate: \$1,500,000

LOCATION OF PROJECT: Greenbelt, Prince George's County, Maryland

COGNIZANT HEADQUARTERS OFFICE: Office of Space Science and Applications

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$128,000	---	\$ 128,000
Capitalized Investment.....	---	<u>\$2,473,640</u>	<u>2,473,640</u>
Total.....	<u>\$128,000</u>	<u>\$2,473,640</u>	<u>\$2,601,640</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for a new 13.8 kilovolt (kv) switching station and associated equipment, located south of Building 25 and east of Soil Conservation Service (SCS) Road. This station will be serviced by two (2) 13.8 KV feeders from the existing main substation. Also included is the installation of new 13.8 KV feeders from the main substation to Building 13A. These improvements will off-load badly overloaded feeders and provide for future expansion east of SCS Road.

PROJECT JUSTIFICATION:

The new switching station will provide flexibility and improve reliability for existing facilities east of SCS Road and will support future growth and development for this area. The new switching station will offload the existing substation feeders by providing capacity to the Goddard Optical Research Facility (Area 200), Magnetic Test Site (Area 300) and the Propulsion Research Site (Area 400), which are located northeast of the Goddard main complex.

The expansion of the existing central substation 13.8 KV switchgear and dedicated feeders to Building 13A will increase the reliability of service to Building 3/13/14 and the main site of the Goddard complex. Since there are no spare cubicles available at the central substation, dedicated feeders to Building 13A and feeders to the new switching station cannot be installed without this expansion. Space to accommodate additional spare 13.8 KV cubicles will be allocated to provide additional flexibility and capability for future load growth at the GSFC.

IMPACT OF DELAY:

Delay of this project will limit growth of the Goddard electrical distribution system and severely constrain the existing system. With several new facilities and additions scheduled, the existing feeders will be loaded near their rated capacity or will exceed their rated values. Delay of this project will also defer needed improvements in the reliability of electrical service to Buildings 3/13/14.

PROJECT DESCRIPTION:

This project will provide two (2) new 13.8 KV padmounted switchgear which will provide power to existing facilities east of SCS Road. The site work, foundations, grounding, ductbank, and all ancillary equipment required for the new switching station are included. The switching station will be served by dual 13.8 KV feeders extended via a new 8-way ductbank from the existing (expanded) main substation. The switching station will have provisions for expansion. Six (6) 13.8 KV switchgear cubicles will be added to the existing main substation. A new feeder will be installed to Building 13A.

PROJECT COST ESTIMATE: Based on a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$1,500,000</u>
New Switching Station.....	---	---	---	1,100,000
Padmount Switchgear.....	LS	---	---	(70,000)
8-Way Ductbank.....	LS	---	---	(700,000)
Feeders to Switching Station.....	LS	---	---	(330,000)
Building 13 Feeders.....				400,000
Central Substation Expansion.....	LS	---	---	(275,000)
8-Way Ductbank.....	LS	---	---	(110,000)
Feeders to Bldg 13A.....	LS	---	---	(15,000)
 Total.....				 <u>\$1,500,000</u>

LIST OF RELATED GRAPHICS:

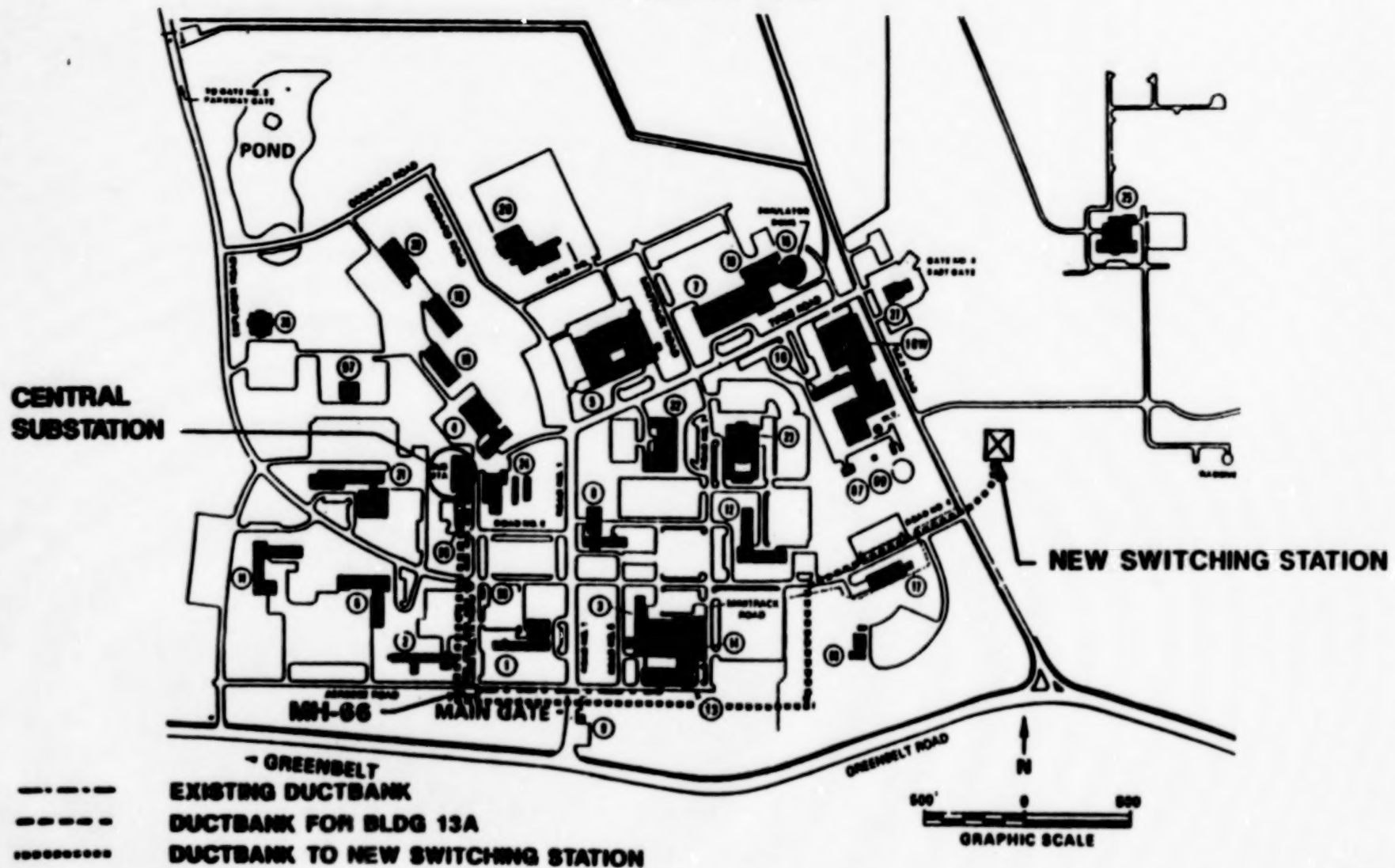
Figure 1 - Location Plan Figure 2 - Schematic Diagram

OTHER EQUIPMENT SUMMARY: None

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

**GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1991 ESTIMATES
REPLACEMENT/MODERNIZATION ELECTRICAL POWER FEEDERS**

LOCATION PLAN



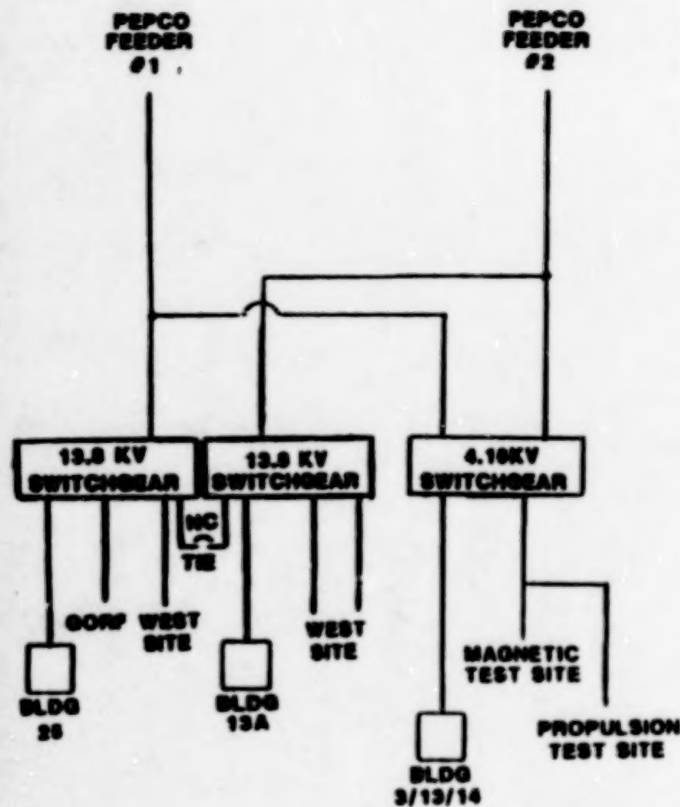
CF 5-21

GODDARD SPACE FLIGHT CENTER

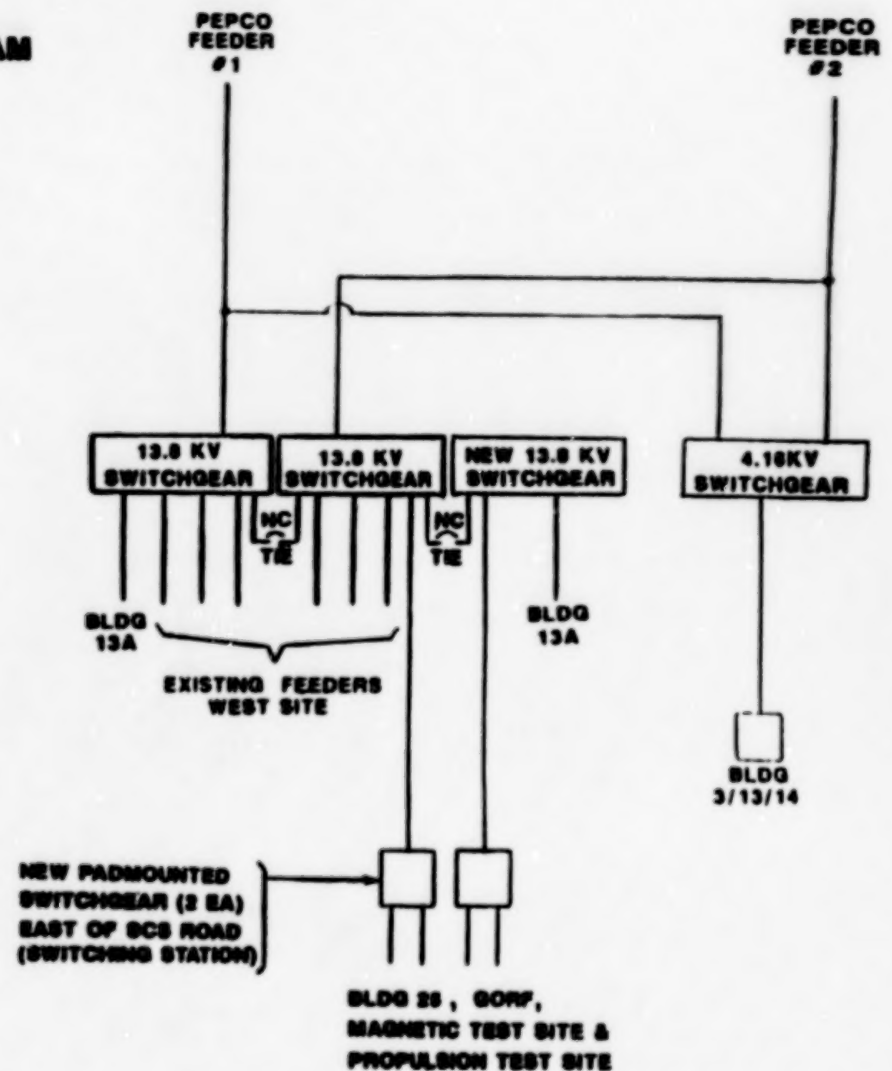
FISCAL YEAR 1991 ESTIMATES

REPLACEMENT/MODERNIZATION ELECTRICAL POWER FEEDERS

SCHEMATIC DIAGRAM



EXISTING ELECTRICAL CONFIGURATION



NEW ELECTRICAL CONFIGURATION CF 5-22

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

SUMMARY

JET PROPULSION LABORATORY

	<u>Amount</u> (Dollars)	<u>Page</u> <u>No.</u>
<u>Office of Space Science and Applications:</u>		
Construction of Observational Instruments Laboratory.....	14,000,000	CF 6-1
Refurbishment of 25-Foot Space Simulator.....	13,200,000	CF 6-7
Total.....	27,200,000 =====	

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CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Construction of Observational Instruments Laboratory

INSTALLATION: Jet Propulsion Laboratory

Total Estimate: \$14,000,000

LOCATION OF PROJECT: La Canada-Flintridge, Los Angeles County, California

COGNIZANT HEADQUARTERS OFFICE: Office of Space Science and Applications

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$990,000	---	\$990,000
Capitalized Investment.....	---	---	---
Total.....	<u>\$990,000</u>	<u>---</u>	<u>\$990,000</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of a multistory 80,000-square-foot laboratory. A controlled environment for assembly, research, and testing of instruments from 1 to over 100 cubic feet and weighting up to 600 pounds will be provided. The Jet Propulsion Laboratory (JPL) is responsible for the development of instruments used in the Earth Surface, Earth Atmosphere, Planetary Exploration and Astrophysics Programs. The present facilities were not designed for the necessary controlled conditions, size or increased number of future space instruments.

CF 6-1

PROJECT JUSTIFICATION:

The significant growth of observational instruments over the next few years will require a new facility that houses imaging systems, infrared and analytical instruments, microwave observational systems and optical science and applications development activities. It must provide the capability to develop observational instruments operating throughout the electromagnetic spectrum. Such instruments require stringent procedural controls as well as control of temperature, humidity, and particulate contamination during manufacture, assembly, test, and calibration.

In addition, the number of instruments requiring processing is increasing steadily. Currently 10 instruments are in some phase of development and testing. The number is expected to reach 20 or more in the 1990's. Also, there is an increase in the size of the instruments e.g., weight, volume, power, and data. Current instruments weigh about 30 pounds and occupy about two cubic feet. Future instruments will weigh around 600 pounds and occupy 100 cubic feet. The general growth in physical size precludes the use of existing facilities. The larger instruments will require cranes and vehicle transporters, which require a facility with vertical and horizontal clearances for this equipment. Also, instruments are becoming increasingly sensitive and will require improved contamination, temperature and humidity control. Future instruments will need an adequate and safe processing facility which presently does not exist at JPL.

IMPACT OF DELAY:

A delay in the construction of the Observational Instruments Laboratory will force continued use of substandard facilities and a re-evaluation of the size and type of instruments that can be developed and processed at JPL. The instrument development work to be performed in the 1990's would be delayed, ultimately affecting science and applications flights into the next century.

PROJECT DESCRIPTION:

This project will construct an approximately 80,000-gross-square-foot steel frame building in the southern sector of JPL, east of Surveyor Road, and south of the Robotics Laboratory, Building 278. The building will include a high-bay assembly area, class 10,000 clean rooms, electronic and optical laboratories necessary for assembly, testing, and calibration, and atmospheric observation laboratory on the roof, and essential support space. Compressed air, gaseous nitrogen, central vacuum systems, liquid nitrogen, and deionized water will be provided. The building electrical systems will include a 480 V and 208 V power distribution system. Grounding will be provided for the power system, safety equipment, electrostatic control and signal reference. A sprinkler system, telephone, utility control, local area networking, and a hardwired instrumentation system will be provided. A central plant adjacent to the structure will accommodate chillers with a total capacity of 530 tons, liquid and gaseous nitrogen storage tanks, and laboratory vacuum and compressed air pumps.

CF 6-2

PROJECT COST ESTIMATE:

Based on Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>14,000,000</u>
Site work.....	LS	---	---	1,600,000
Architectural/structural.....	SF	80,000	80.00	6,400,000
Mechanical.....	SF	80,000	45.00	3,600,000
Electrical.....	SF	80,000	30.00	2,400,000
Total.....				<u>\$14,000,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan

Figure 2 - Project Rendering

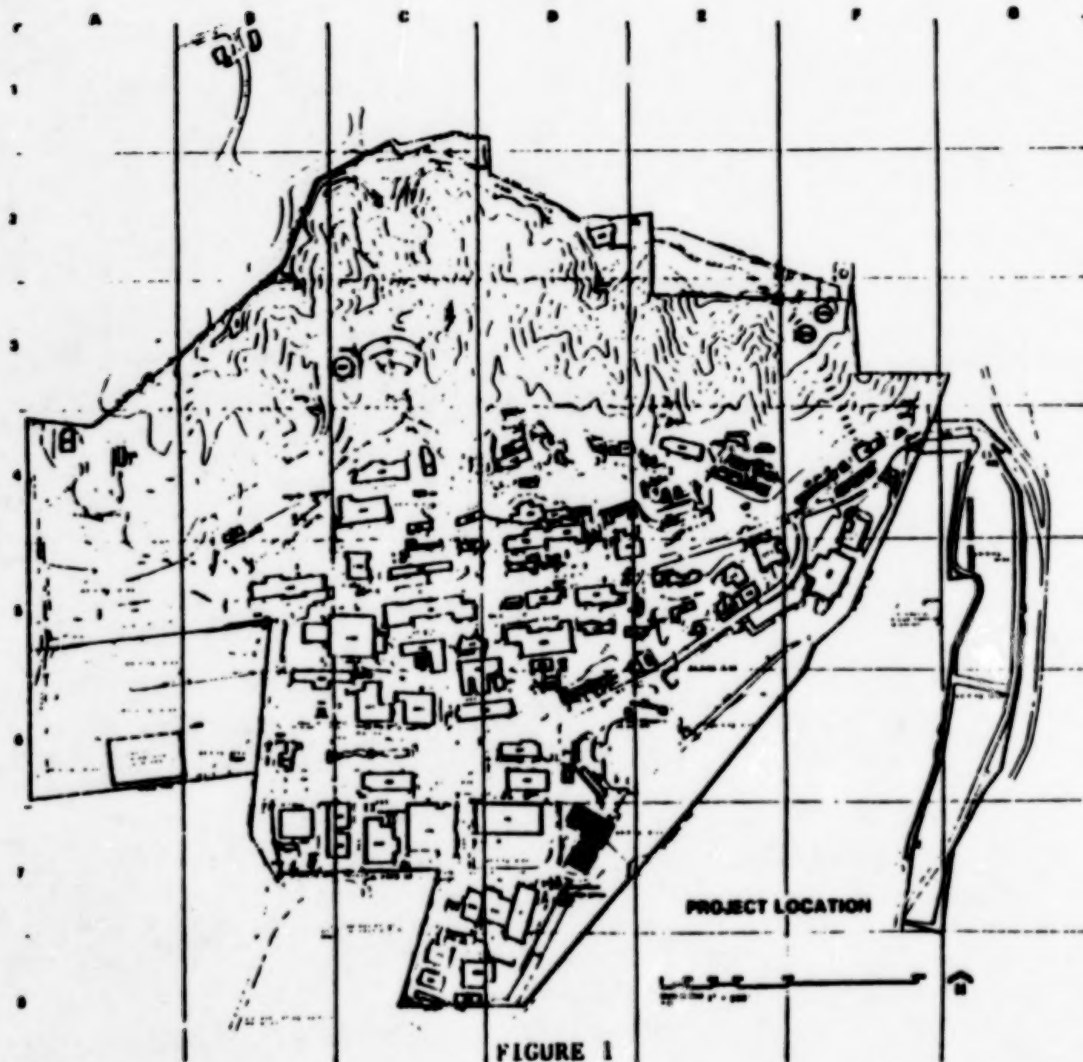
Figure 3 - Typical Floor Plan

OTHER EQUIPMENT SUMMARY:

Approximately \$7,000,000 of R&D-funded equipment, including veiling glare and scatter light facility and collimator, will be required.

FUTURE CoF FUNDING REQUIRED TO COMPLETE THIS PROJECT: None anticipated at this time.

JET PROPULSION LABORATORY
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF OBSERVATIONAL INSTRUMENTS LABORATORY
LOCATION PLAN



CF 6-4

**JET PROPULSION LABORATORY
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF OBSERVATIONAL INSTRUMENTS LABORATORY
PROJECT RENDERING**

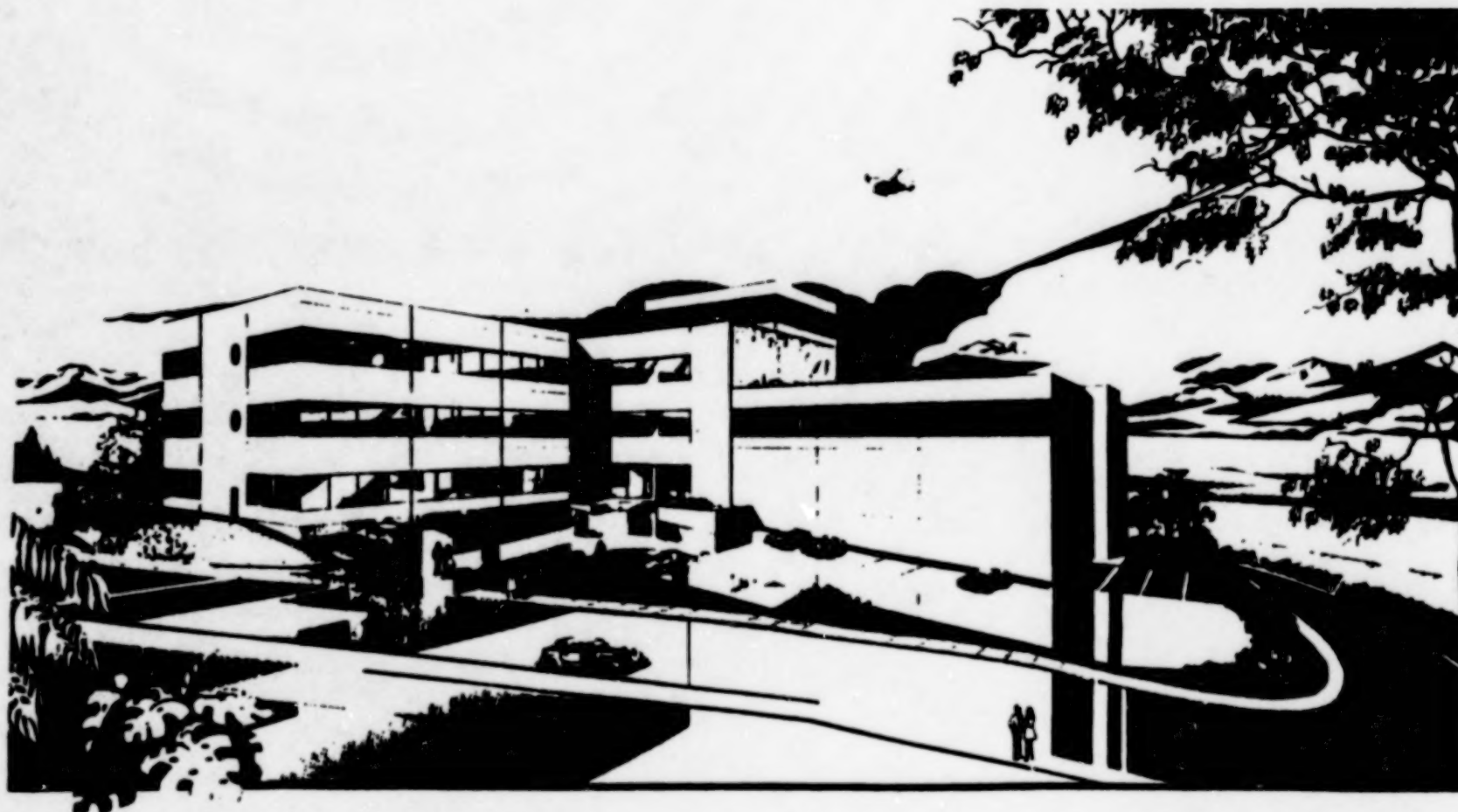


FIGURE 2

CF 6-5

Figure 3 is a detailed floor plan of the second floor. The plan is oriented with North at the top. Key features include:

- Entrance:** A Vestibule (VEST) and Corridor (CORRIDOR) lead into the main area.
- Restrooms:** Multiple Rest (REST) rooms are distributed throughout the floor.
- Specialized Rooms:**
 - Micro:** Microscopy room.
 - Camera:** Photography room.
 - Optical:** Optical rooms for various experiments.
 - Optical Laboratory:** A larger room for optical studies.
 - Optical Assembly:** A room for assembling optical equipment.
- Support Rooms:**
 - Fire Control Room:** For fire safety monitoring.
 - Elevator Lobby:** Lobby for the elevator.
 - CONF:** Conference rooms.
 - OFFICE:** Office spaces.
 - RECH BRAFT:** A room labeled as such, possibly a rest or break area.
- Dimensions:** The plan includes various dimensions for rooms and corridors, such as 10'-0", 12'-0", 14'-0", 16'-0", and 18'-0".
- North Arrow:** Located in the bottom right corner, pointing towards the top of the page.

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CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Refurbishment of 25-Foot Space Simulator

INSTALLATION: Jet Propulsion Laboratory

FY 1991 CoF Estimate: \$13,200,000

LOCATION OF PROJECT: La Canada-Flintridge, Los Angeles County, California

COGNIZANT HEADQUARTERS OFFICE: Office of Space Science and Applications

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$863,000	\$ ---	\$ 863,000
Capitalized Investment.....	---	<u>2,433,525</u>	<u>2,433,525</u>
Total.....	<u>\$863,000</u>	<u>\$2,433,525</u>	<u>\$3,296,525</u>

SUMMARY PURPOSE AND SCOPE:

This project will refurbish the 25-foot Space Simulator, Building 150, by resurfacing the 23-foot diameter solar simulator collimating mirror, replacing the existing power supply rectifiers of the solar simulation system, and replacing the obsolete oil diffusion pumps with new cryogenic pumps. The space simulator chamber has been used on each of the JPL major flight projects such as the Mariners, Viking, Voyager, Infrared Astronomical Satellite (IRAS) and Galileo. Without these modifications, this vital space simulator test capability for future flight projects will be lost.

PROJECT JUSTIFICATION:

The collimating mirror is the largest optical element of the solar simulator system, and was fabricated in 1965. Each major JPL flight project such as the Mariners, Viking, Voyager, IRAS, and Galileo used this mirror's test capability. Future planetary exploration projects will also utilize its test capability. The condition of the mirror's nickel substratum has deteriorated over the years so that the specified test intensity of the solar beam cannot be maintained. The mirror surface has deteriorated to where the reflectivity is less than 50 percent. Some isolated areas are currently producing only 12 percent reflectance. Corrosion pits and bubbles have appeared across the entire nickel surface. This condition now requires full power of all solar lamps for each test. The original simulator's capability of 2.0 solar constants intensity has deteriorated to only 1.0 solar constants. If this deterioration is allowed to continue, the chamber will become inoperable and future flight projects cannot be tested.

The current solar simulation system consists of lamps and rectifiers that were purchased in 1961. These rectifiers are experiencing mechanical and electrical component failures at an increasing rate. Replacement parts are no longer available, and parts salvaged from other units have been used to maintain operation. Continuance of this practice will shortly not be feasible.

Presently, the chamber uses obsolete oil diffusion pumps for pressure reduction which have a very high probability of contaminating optical instruments with oil particles during a test. This project will replace the contaminating oil diffusion pumps with cleaner and more efficient cryopumps that will keep optical and sensor elements clean during vacuum operations.

IMPACT OF DELAY:

Delay of this project will further reduce the capability of the space simulator to a point where acceptable light uniformity and intensity cannot be produced and future flight projects cannot be tested prior to launch.

PROJECT DESCRIPTION:

This project will resurface the 23-foot diameter solar simulator collimating mirror, replace the existing power supply rectifiers of the solar simulation system, convert the oil diffusion pumping system to a new cryogenic and turbo-molecular system and update the corresponding section of the central console.

The 23-foot diameter mirror will be reground and plated. The deteriorating power supply rectifiers of the solar simulation system will be replaced with new high-efficiency rectifiers and the power system will also be modified and updated to suit the new rectifiers. Oil diffusion pumps of the space simulator chamber will be replaced with cryogenic pumps installed in existing ports. Two new turbo pumps will also be installed to provide pumping of helium, hydrogen, and the lighter gases. This work will also include all of the necessary nitrogen piping, insulation, structural, and electrical modifications, including reworking the existing pressure/temperature instrumentation and control board, to accommodate the new cryopump requirements. Work required will take approximately two years.

PROJECT COST ESTIMATE: Based on final design.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Construction</u>	---	---	---	<u>13,200,000</u>
Modify Lamp Power Supply.....	LS	---	---	2,750,000
Resurface Mirror.....	LS	---	---	4,650,000
Modify Vacuum Pumping System.....	LS	---	---	5,800,000
Total.....				<u>\$13,200,000</u>

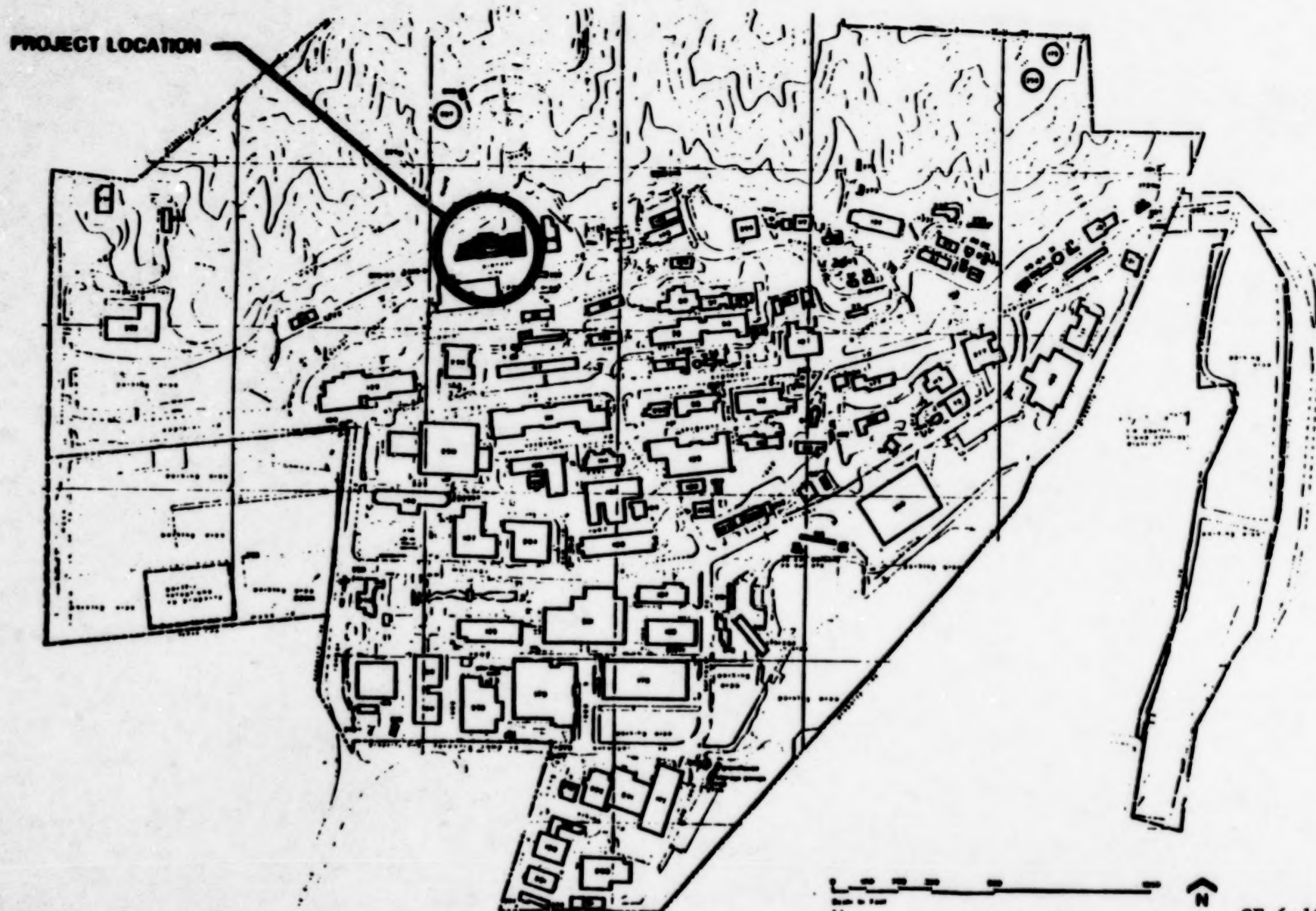
LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Schematic Section

OTHER EQUIPMENT SUMMARY: None

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

**JET PROPULSION LABORATORY
FISCAL YEAR 1991 ESTIMATES
REFURBISHMENT OF 25-FOOT SPACE SIMULATOR
LOCATION PLAN**



**JET PROPULSION LABORATORY
FISCAL YEAR 1991 ESTIMATES
REFURBISHMENT OF 25-FOOT SPACE SIMULATOR
LOCATION PLAN**

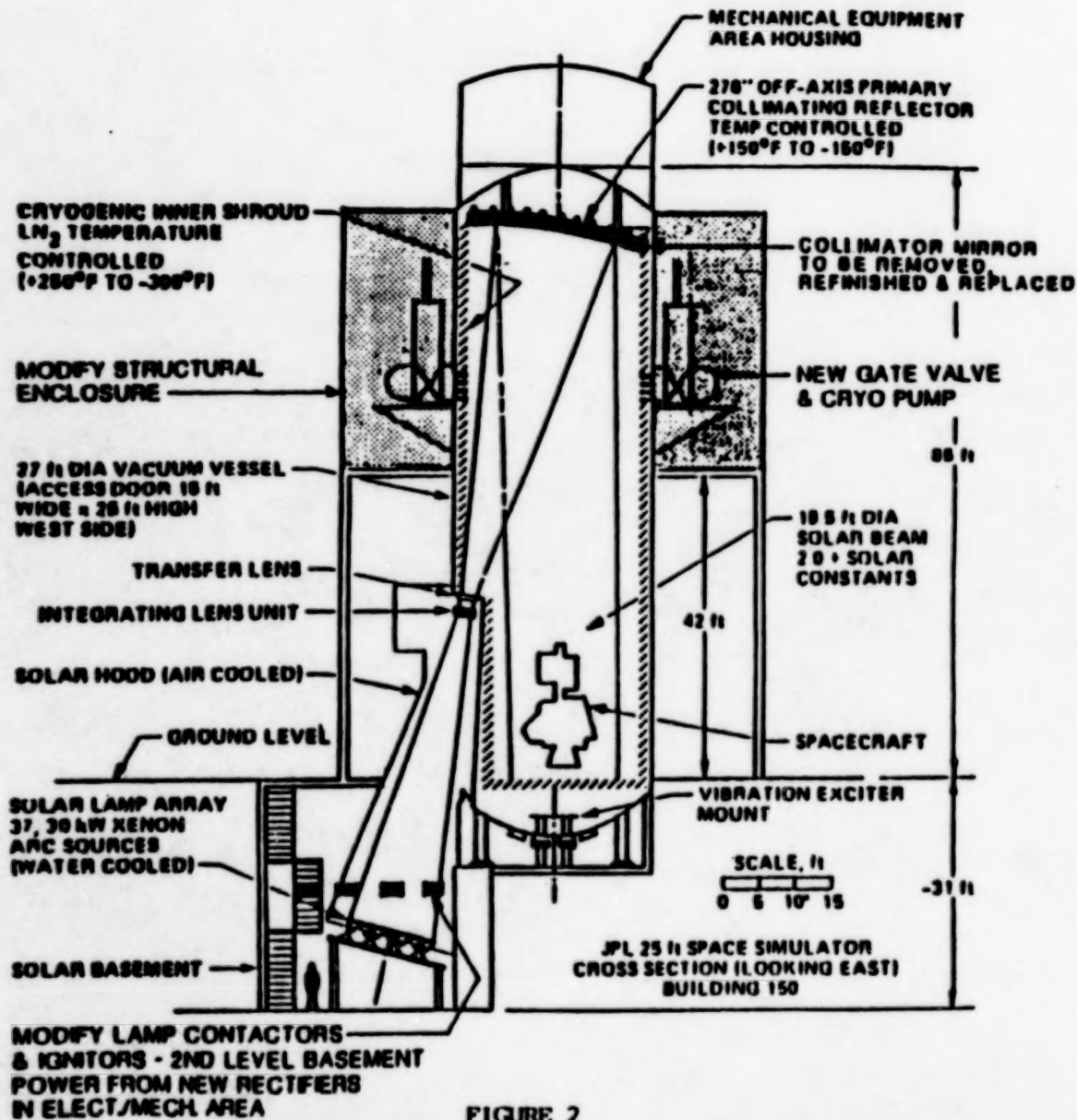


FIGURE 2

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

SUMMARY

Wallops Flight Facility

	Amount	Page No.
	(Dollars)	
Office of Space Science and Applications:		
Restoration of Utilities.....	5,200,000	CF 7-1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Restoration of Utilities

INSTALLATION: Wallops Flight Facility

FY 1991 CoF Estimate: \$5,200,000

LOCATION OF PROJECT: Wallops Flight Facility, Wallops Island, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Space Science and Applications

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$468,000	---	\$ 468,000
Capitalized Investment.....	---	<u>\$9,969,962</u>	<u>9,969,962</u>
Total.....	<u>\$468,000</u>	<u>\$9,969,962</u>	<u>\$10,437,962</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the restoration of utility systems (water, sewer, electrical distribution and fuel tank farm) at the Wallops Flight Facility. The project will replace antiquated, deteriorated systems, enhance system reliability and reduce operation and maintenance costs.

PROJECT JUSTIFICATION:

Restoration of the water system is necessary to conform with State Health Department standards for domestic water supplies and to provide reliable fire protection water capacity. Cleaning the existing water mains is necessary to remove 30 to 40 years of build-up inside the pipes. This will restore the carrying capacity of the mains. The existing Main Base wells are over 40 years old and must be replaced with deeper wells to ensure continuing water supply, to improve the water quality, and to decrease the potential for well contamination from surface waters. Alterations to the 40-year-old Main Base water treatment facilities are also required to comply with current State Health Department standards. Recent building additions also require the installation of new water mains, fire hydrants and valves in these areas to ensure adequate fire protection. Water mains on the south end of Wallops Island also require replacement with larger sizes.

The proposed rehabilitation of the Main Base and Island sewer systems will reduce potential pollution problems and help remedy the present overloading of the treatment facilities thereby reducing operation and maintenance costs. Rehabilitation of these lines will provide environmental improvements and increased health protection.

Restoring the electrical system will replace 20 to 40 year old oil filled switches on Wallops Island that frequently break down, and high voltage regulators will be installed to improve the distribution voltage. The present low voltage causes electric motors to overheat and fail. A new electrical service is required to rectify overloaded systems in the cafeteria building.

The installation of new fuel tanks and leak detection system is necessary to comply with state and federal environmental regulations and provide required operational support of flight activities from Wallops which is the staging area for all eastern ER-2 aircraft activities.

IMPACT OF DELAY:

Delay of this project will force continued use of utility systems which have deteriorated from age, no longer meet health, safety and environmental regulations, are unreliable, and do not adequately support Wallops activities.

PROJECT DESCRIPTION:

This project provides for: the rehabilitation of approximately 96,000 linear feet of water mains and appurtenances and 41,000 linear feet of gravity sewer mains and appurtenances; the installation of approximately 5,800 linear feet of 10-inch water main on Wallops Island and 3,500 linear feet of 14-inch water main on the Main Base; replacement of the Main Base water treatment system including all controls; the installation of two new well facilities on the Main Base with abandonment of all 13 of the old Main Base wells; the replacement of nine oil filled primary selector switches; and 19 - 2,400 volt primary transformers;

and the installation of a medium voltage regulator, 6,000 feet of duct bank, manholes, cable and renovation of the electrical service in Building E-2. The aviation fuel system work includes installation of two new 10,000 gallon Jet Propellant Thermally Stable (JPTS) fuel tanks, associated dispensing equipment, a storage tank for contaminated JPTS fuel and a leak detection system.

PROJECT COST ESTIMATE: Based on a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$5,200,000</u>
Water.....	LS	---	---	1,700,000
Sanitary Sewer.....	LS	---	---	1,300,000
Electrical.....	LS	---	---	800,000
Aviation Fuel Storage.....	LS	---	---	1,400,000
<u>Total</u>				<u>\$5,200,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Main Base Water System Figure 3 - Island Water System
Figure 4 - Main Base Sanitary Sewer System Figure 5 - Island Sanitary Sewer System
Figure 6 - Main Base Electrical System Figure 7 - Island Electrical Distribution System
Figure 8 - Main Base Aviation Fuel Tanks

OTHER EQUIPMENT SUMMARY: No other equipment is required to complete this project

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: Future CoF funding maybe required to restore additional parts of the utility system.

**WALLOPS FLIGHT FACILITY
FISCAL YEAR 1991 ESTIMATES
RESTORATION OF UTILITIES**

LOCATION PLAN

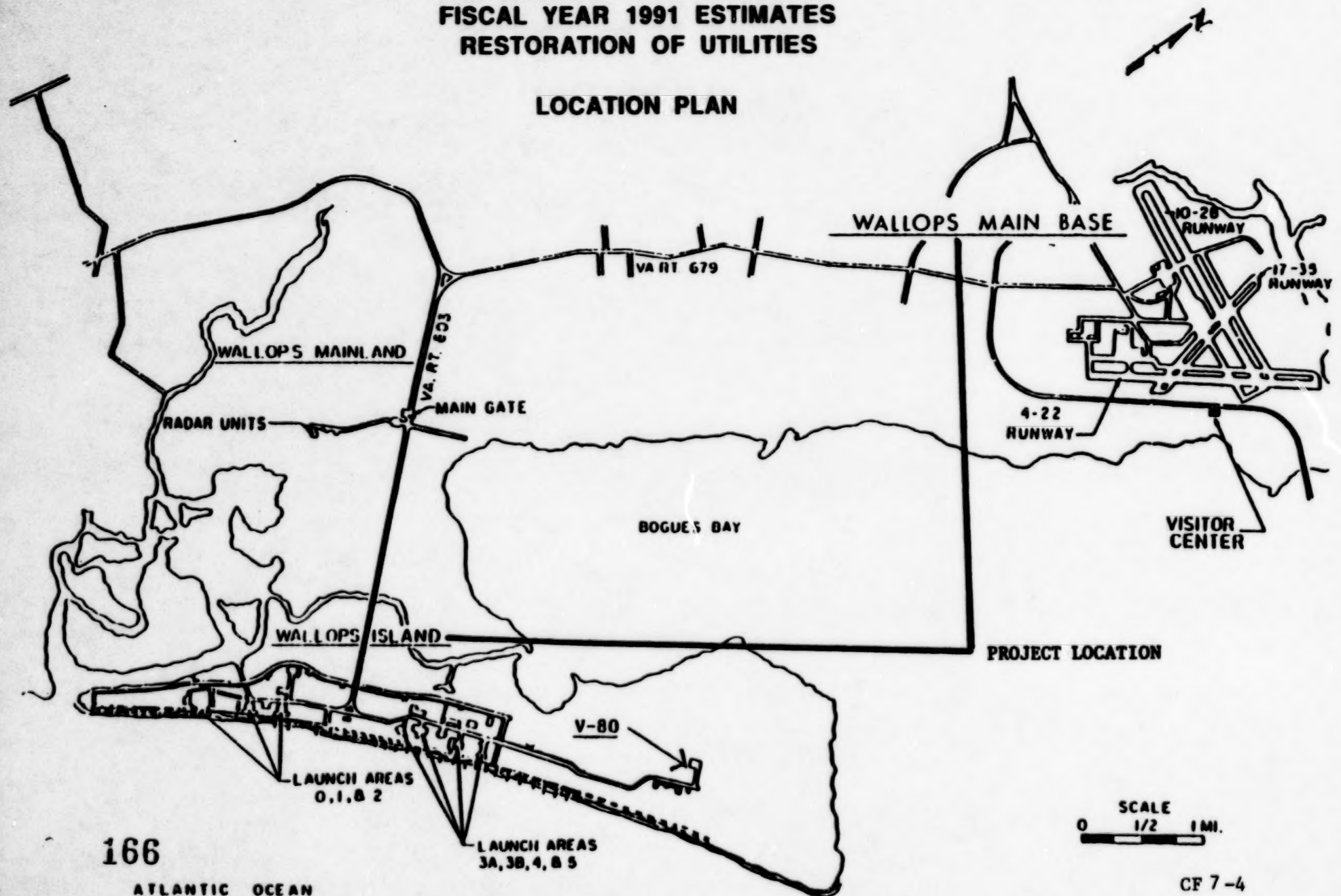
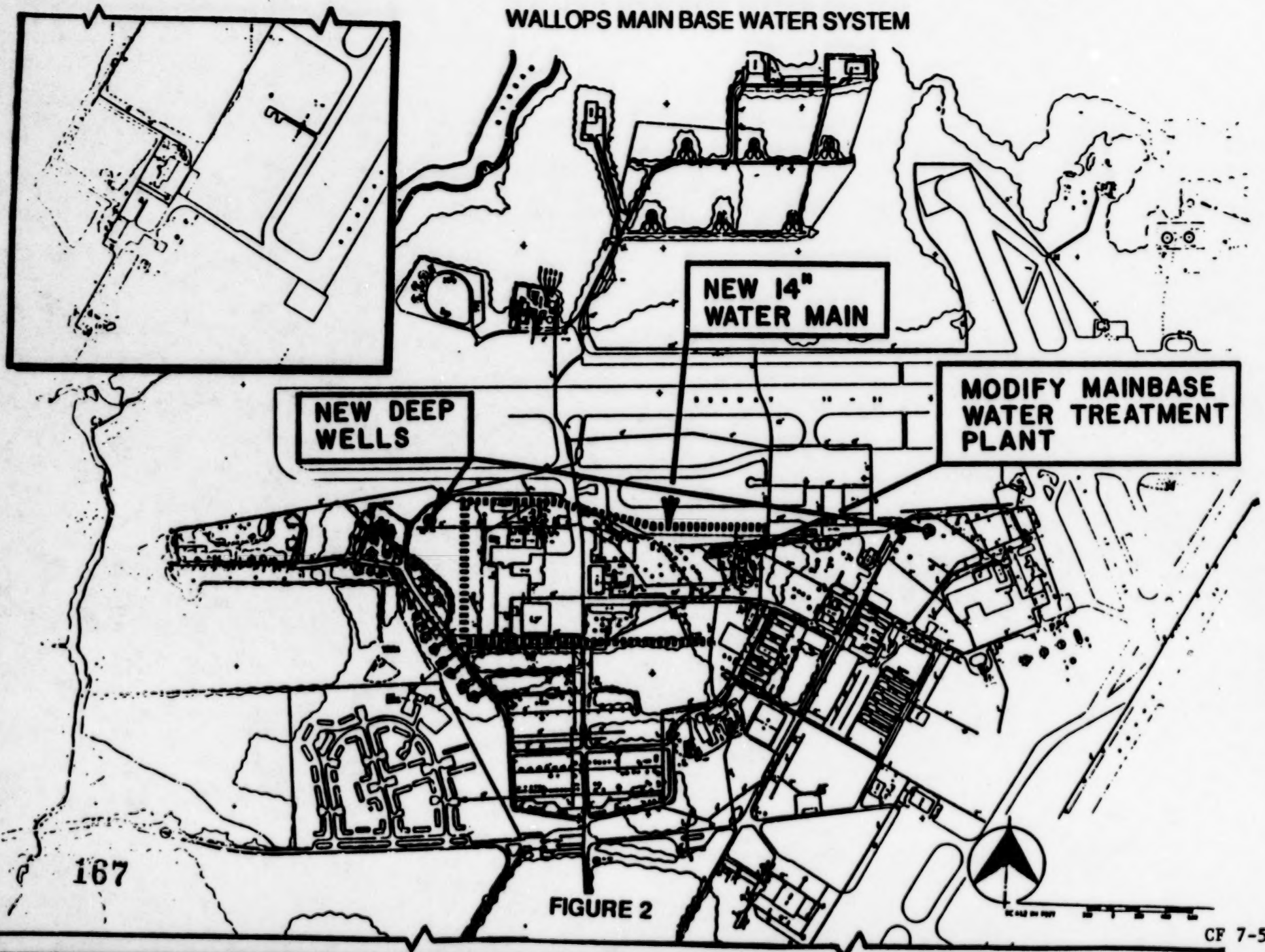


FIGURE 1

CF 7-4

WALLOPS FLIGHT FACILITY
FISCAL YEAR 1991 ESTIMATES
RESTORATION OF UTILITIES

WALLOPS MAIN BASE WATER SYSTEM



WALLOPS FLIGHT FACILITY
FISCAL YEAR 1991 ESTIMATES
RESTORATION OF UTILITIES

WALLOPS ISLAND WATER SYSTEM

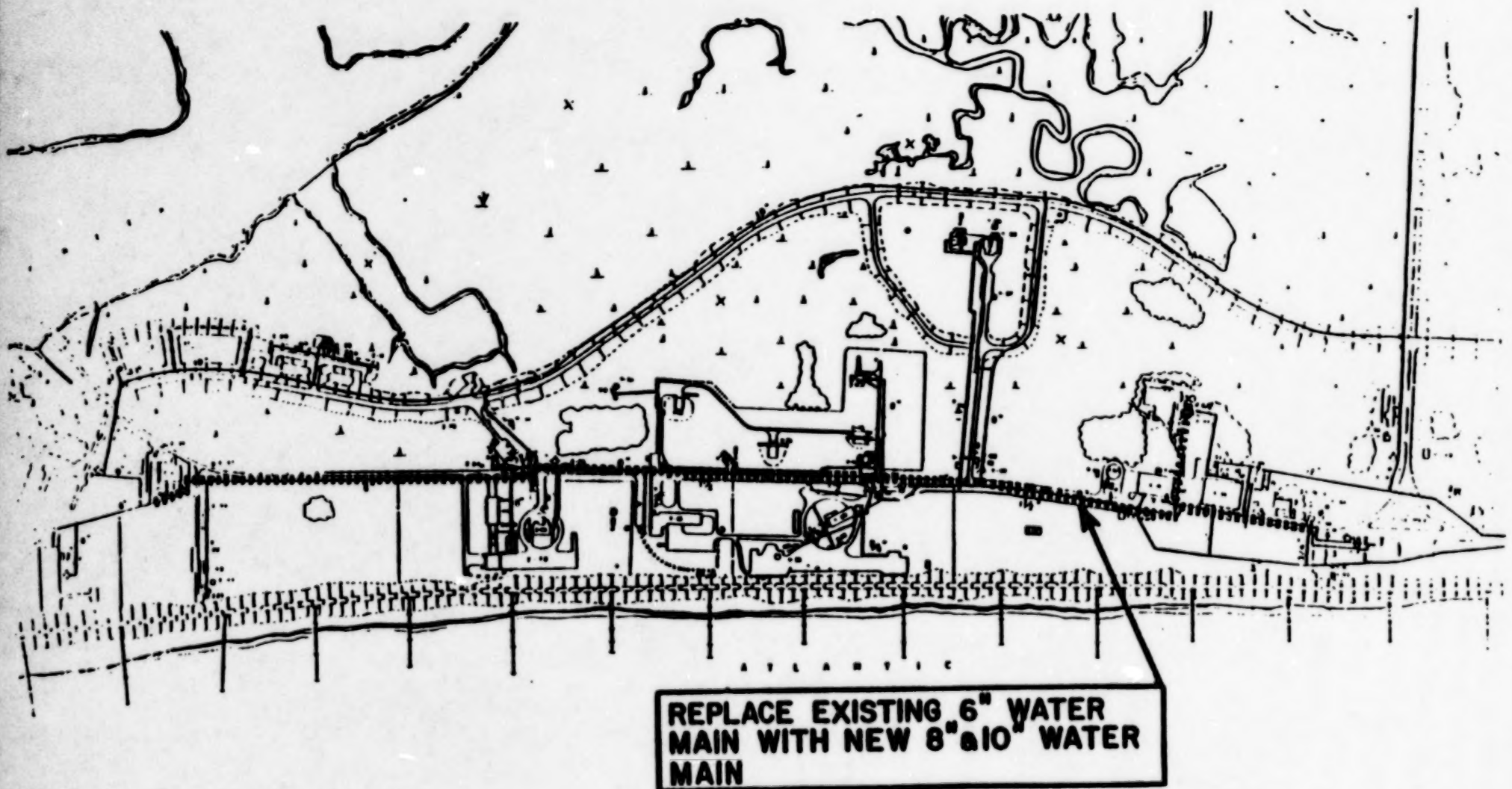
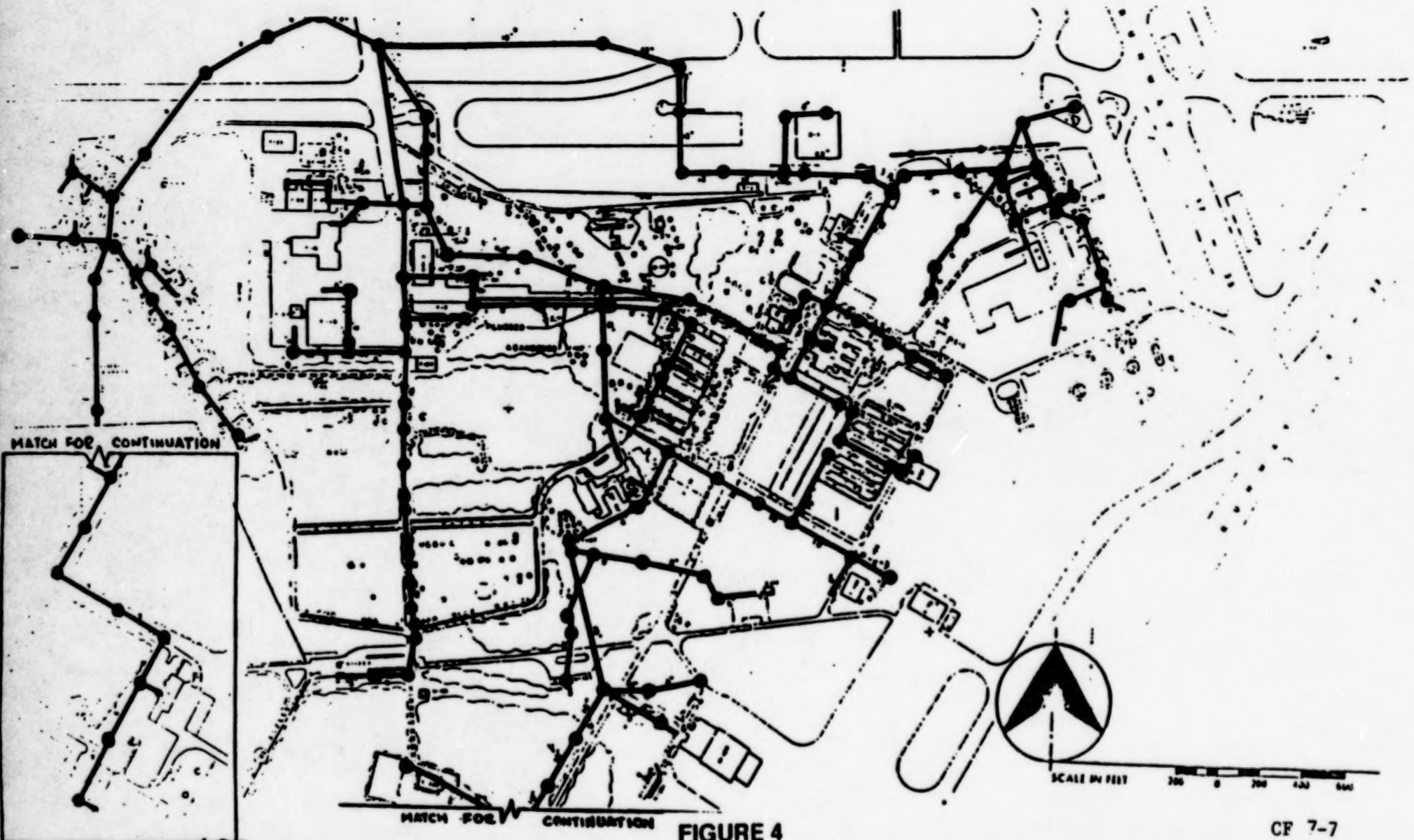


FIGURE 3



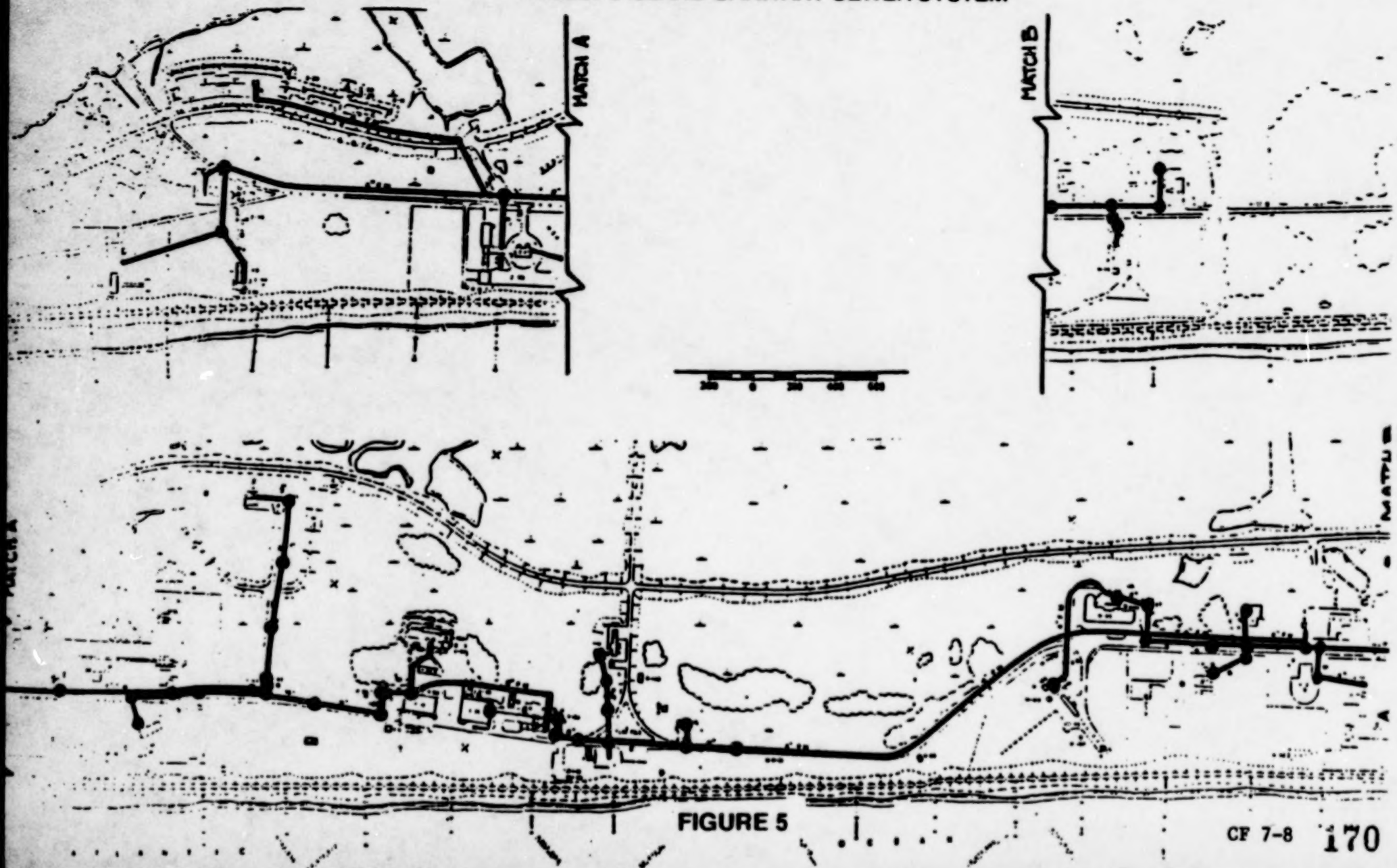
WALLOPS FLIGHT FACILITY
FISCAL YEAR 1991 ESTIMATES
RESTORATION OF UTILITIES

WALLOPS MAIN BASE SANITARY SEWER SYSTEM



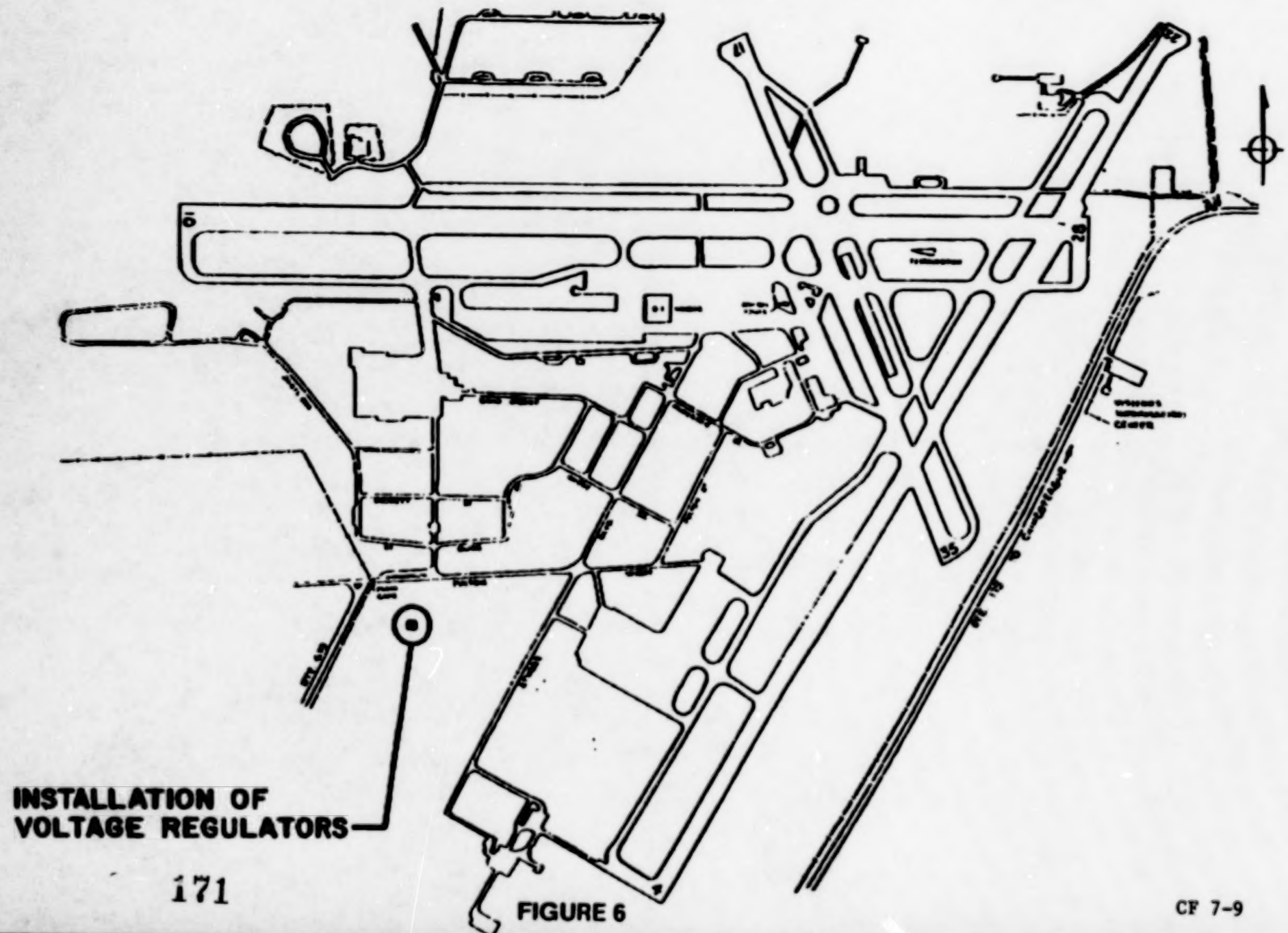
WALLOPS FLIGHT FACILITY
FISCAL YEAR 1991 ESTIMATES
RESTORATION OF UTILITIES

WALLOPS ISLAND SANITARY SEWER SYSTEM

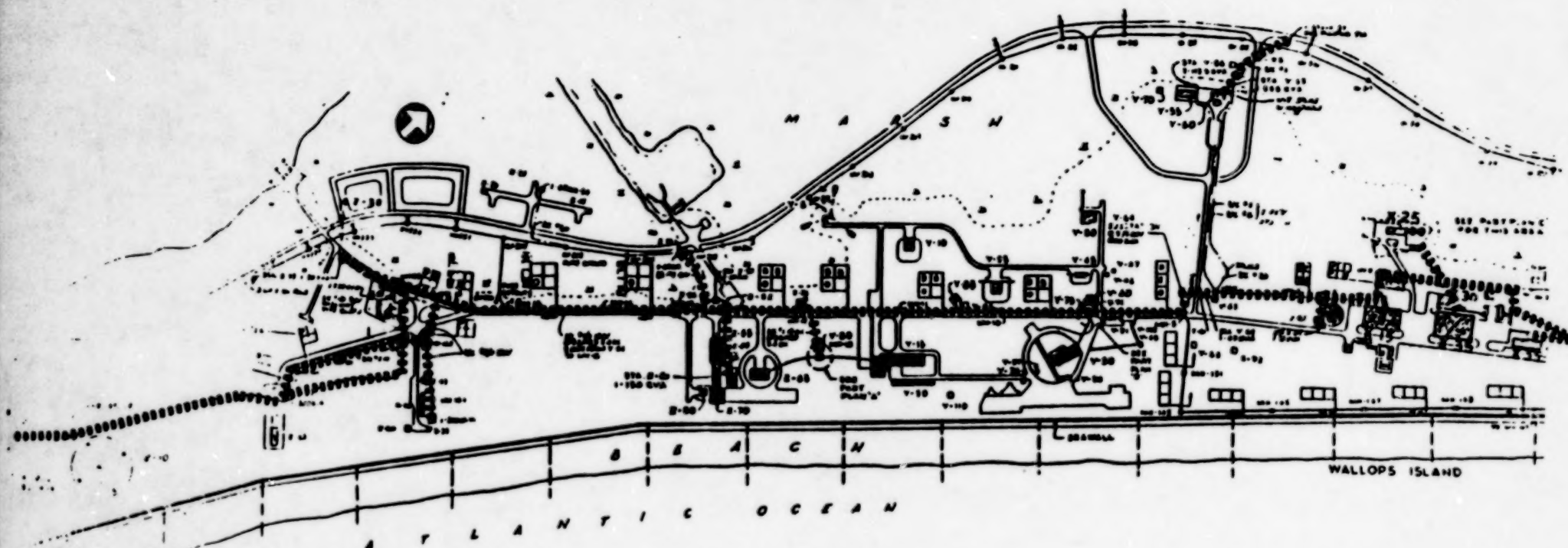


WALLOPS FLIGHT FACILITY
FISCAL YEAR 1991 ESTIMATES
RESTORATION OF UTILITIES

WALLOPS MAIN BASE ELECTRICAL SYSTEM

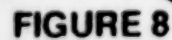


WALLOPS ISLAND ELECTRICAL DISTRIBUTION SYSTEM



CF 7-10

WALLOPS MAIN BASE AVIATION FUEL TANKS



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1991 ESTIMATES
SUMMARY

AERONAUTICAL FACILITIES REVITALIZATION

	<u>Amount</u> (Dollars)	<u>Page</u> <u>No.</u>
<u>Office of Aeronautics and Space Technology:</u>		
Modifications to the High Pressure Air System, Langley Research Center.....	12,000,000	CF 8-1
Modifications to Upgrade the 30X60-Foot Wind Tunnel, Langley Research Center.....	4,000,000	CF 8-6
Repairs to the Tunnel Shell, Unitary Plan Wind Tunnel, Langley Research Center.....	2,700,000	CF 8-11
Rehabilitation of Central Air System, Lewis Research Center.....	7,900,000	CF 8-16
Rehabilitation of Propulsion Systems Laboratory, Lewis Research Center.....	6,000,000	CF 8-21
	<u>32,600,000</u>	
	=====	
Total.....	32,600,000	
	=====	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Modifications to High Pressure Air System

INSTALLATION: Langley Research Center

FY 1991 CoF Estimate: \$12,000,000

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$100,000	--	\$ 100,000
Capitalized Investment.....	---	<u>\$3,782,218</u>	<u>3,782,218</u>
Total.....	<u>\$100,000</u>	<u>\$3,782,218</u>	<u>\$3,882,218</u>

SUMMARY PURPOSE AND SCOPE:

This project will significantly enhance the high pressure air delivery system at the Langley Research Center (LaRC). This system is an essential element for operation of the hypersonic facilities and is used by all other major research facilities. The high pressure air usage has been steadily increasing over the past five years and has reached a critical point where new and modified facilities coming on-line can not be accommodated.

This project will provide an additional 20,000 cubic feet of storage volume, manifolding, supports and necessary valving thereby significantly improving the high pressure air system.

CF 8-1

PROJECT JUSTIFICATION:

The existing air storage system has been derated from 5,000 psi to 4,250 psi allowable working pressure. Also, the 3,000 psi underground storage system has been completely removed from service due to deteriorating coordination. These events have reduced the LaRC usable air storage capability more than 40 percent. The current compressor and air storage combination can only provide about 50 percent of the maximum daily demand. Additional storage is needed to bring the ratio to 65 percent of the maximum daily demand. The long-term goal for LaRC is to provide 90 percent of the maximum daily demand. There are currently 25 major users of the high pressure air systems. The prime users of the high pressure air systems are the hypersonic blowdown tunnels. The increased emphasis on hypersonic research data will require additional hypersonic tunnel operation. There have been several new users (National Transonic Facility, 20-inch Supersonic Wind Tunnel, and Aircraft Landing Dynamics Facility) and upgrading of other facilities (8-Foot High-Temperature Tunnel, 14- by 22-Foot Tunnel, and 16-Foot Tunnel) that have caused or will cause a severe impact on the existing high pressure air system's ability to keep up with demand.

IMPACT OF DELAY:

Delay of this project will adversely affect the research programs at LaRC by causing longer experiment standby times due to lack of high pressure air availability. These tunnel facilities are under heavy demands by Department of Defense agencies and NASA project offices for high performance aircraft/spacecraft development. A reliable and adequate air supply is essential to maintain current research schedules.

PROJECT DESCRIPTION:

Storage Vessels - An additional 20,000 cubic feet of air storage will be added to the existing system. The new system vessels will be designed and manufactured in accordance with the latest boiler and pressure codes.

Manifolding - The storage vessels will be manifolded together to provide 500 pounds per second mass flow, to satisfy all projected tunnel flow requirements. This manifold will be designed in accordance with latest edition of American Society of Mechanical Engineers/American National Standards Institute (ASME/ANSI) B31.3 piping code for use at 6300 psi or greater with a long life span.

Valves - A valving system will be designed to interconnect the existing 4,250 psi storage and distribution system to the new 6,000 psi storage vessel manifold. These valves will consist of two isolation valves, a vent valve, and a pressure regulating valve. These valves will all be designed and fabricated to ASME/ANSI B16.34 criteria.

PROJECT COST ESTIMATE: Based on in-house engineering data, and Preliminary Design Review.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$12,000,000</u>
Storage.....	LS	---	---	8,786,000
Manifold.....	LS	---	---	1,098,000
Valves.....	LS	---	---	1,430,000
Welding and Supports.....	LS	---	---	686,000
Total.....				<u>\$12,000,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - West Area High Pressure Air Distribution System

OTHER EQUIPMENT SUMMARY: None

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Additional modifications to High Pressure Air System are planned for FY 1992 at an estimated cost of \$12.0M.

**LANGLEY RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATE
MODIFICATIONS TO HIGH PRESSURE AIR SYSTEM**

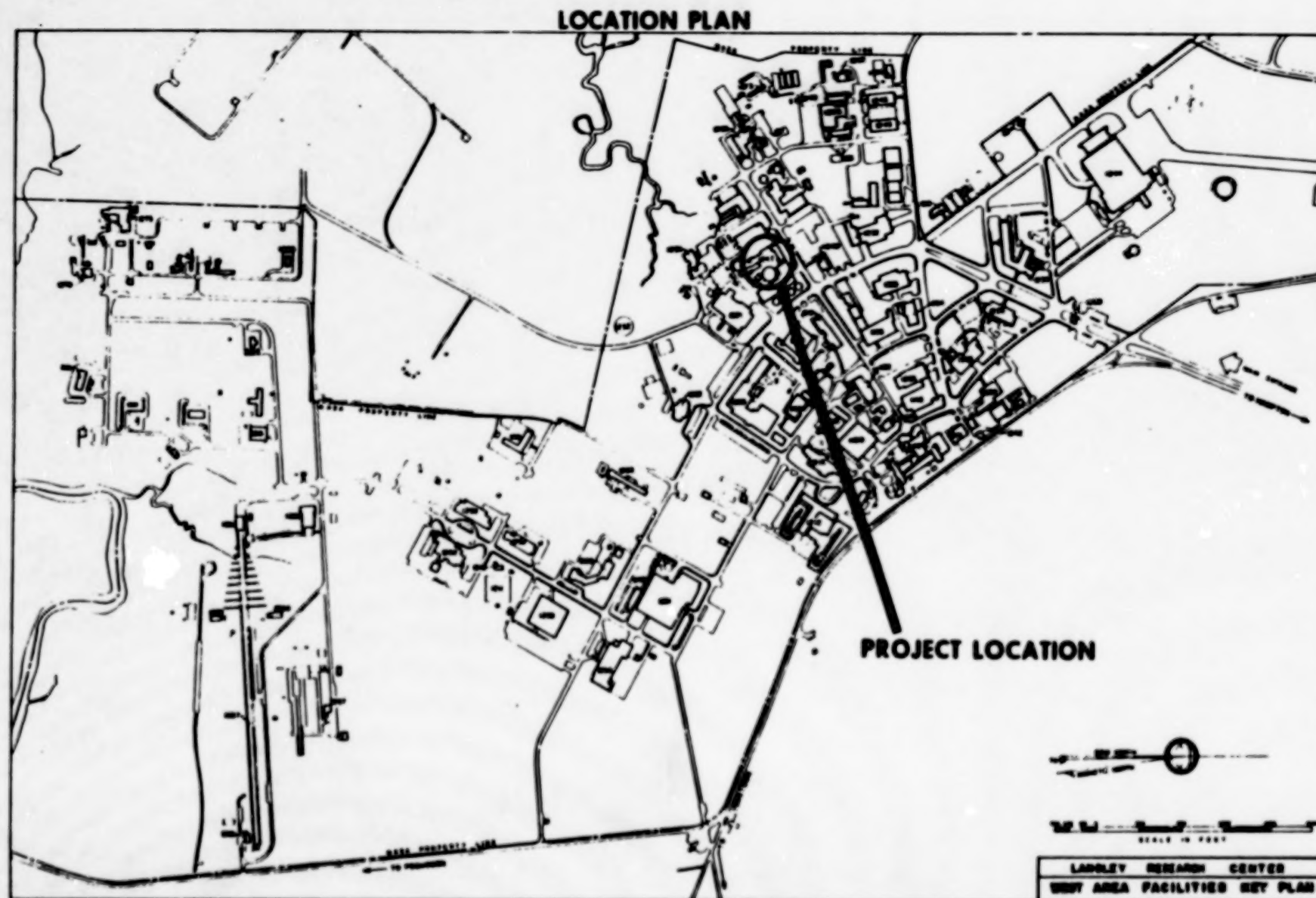


FIGURE 1

CF 8-4

**LANGLEY RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATE
MODIFICATIONS TO HIGH PRESSURE AIR SYSTEM
West Area
High Pressure Air Distribution System**

New 6000 PSIG Storage



Augment Existing Storage

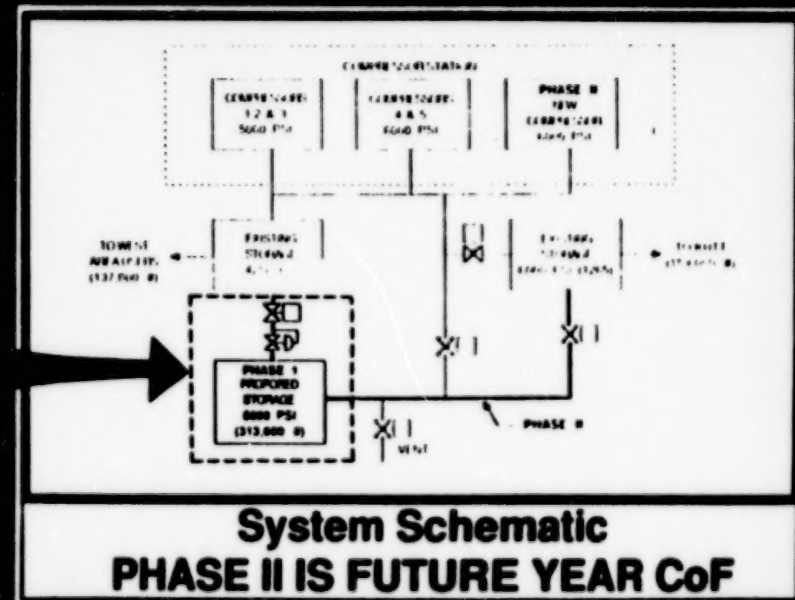


FIGURE 2

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Modifications to Upgrade the 30X60-Foot Wind Tunnel

INSTALLATION: Langley Research Center

FY 1991 CoF Estimate: \$4,000,000

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$480,000	\$ ---	\$ 480,000
Capitalized Investment.....	---	<u>10,639,169</u>	<u>10,639,169</u>
Total.....	<u>\$480,000</u>	<u>\$10,639,169</u>	<u>\$11,119,169</u>

SUMMARY PURPOSE AND SCOPE:

This project is part of the NASA Aeronautical Facilities Revitalization Program. This project will correct deficiencies and upgrade testing capability in the 30X60-Foot Tunnel to address increased requirements for high-angle-of-attack stability and control research and development of advanced aircraft and space vehicle configurations. The project will also provide an increased capability for the model propulsion air system to satisfy current and future requirements for research and development testing in the area of propulsive control technology.

CF 8-6

PROJECT JUSTIFICATION:

The 30X60-Foot Wind Tunnel has a unique capability for high-angle-of-attack stability and control testing. The increased capabilities provided by this project are urgently needed because: an increased emphasis on the development of high-angle-of-attack propulsive control technology for highly maneuverable fighter aircraft has created a new and continuing demand for increased levels of simulated thrust; the current sources of compressed air for tests in the 30X60-Foot Wind Tunnel are inadequate to meet the projected needs for testing in this area; and a requirement to better understand the complex flow fields around advanced configurations at high-angles-of-attack creates a need to improve capability and accuracy for flow survey equipment.

IMPACT OF DELAY:

Delay of this project will result in the 30X60-Foot Wind Tunnel operating at less than maximum efficiency and productivity thereby reducing its effectiveness in meeting the requirements for high-angle-of-attack research.

PROJECT DESCRIPTION:

Model Propulsion Air System Upgrade - This element upgrades the capability of the model propulsion air system. The requirement is for continuous flow propulsion at a maximum mass flow rate of 10 pounds per second at 700 psig. The new system will consist of multiple air compressors staged together to provide partial flow combinations up to the maximum flow at optimum power consumption levels. The system will include the compressors, cooling tower, dryers, electrical switchgear, couplings/clutches, filters and related piping distribution system modifications. Additionally, due to severe space constraints within the existing structure, and the expected high noise and vibration levels of the new air compressors, a new small building adjacent to the facility will be required to house the air supply system.

Survey Equipment Upgrade - This element repairs and upgrades the flow survey carriage for increased weight capability and reliability and provides for remote computer control for position with increased position accuracy. The gears and following trolleys on the existing carriage will be repaired and upgraded to allow an instrumentation package of approximately 700 pounds to be positioned in the flow field. Remote computer control with a repeatable accuracy of ± 0.05 inches will be provided for positioning control of the survey carriage about three axes. Ramp inputs will be provided for all positions.

PROJECT COST ESTIMATE: Based on a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$4,000,000</u>
Air Compressor System.....	LS	---	---	3,431,560
Survey System Mods.....	LS	---	---	<u>568,440</u>
Total.....				<u><u>\$4,000,000</u></u>

LIST OF RELATED GRAPHICS:

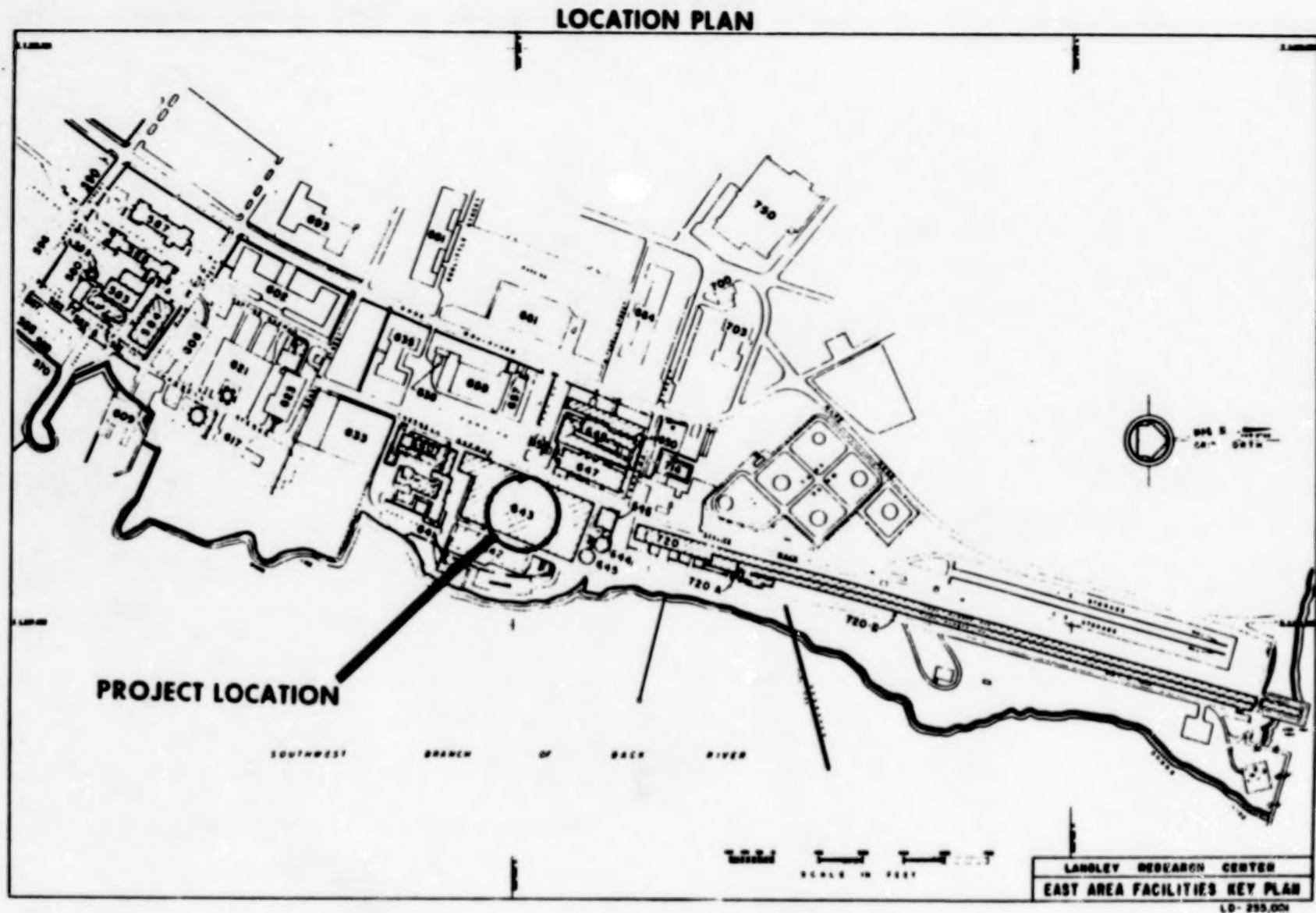
Figure 1 - Location Plan Figure 2 - Tunnel Mods

OTHER EQUIPMENT SUMMARY: None

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Modifications to upgrade flow quality in the 30X60-Foot Wind Tunnel are planned for FY 1993 at an estimated cost of \$2.2M.

**LANGLEY RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATE
MODIFICATIONS TO UPGRADE THE 30X60-FOOT WIND TUNNEL**



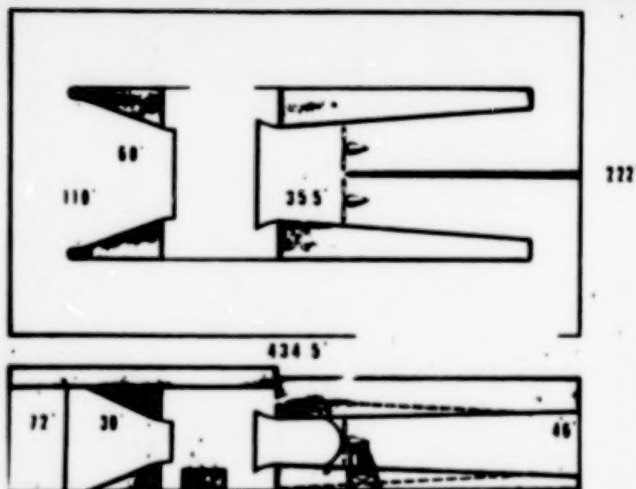
**LANGLEY RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATE
MODIFICATIONS TO UPGRADE THE 30X60-FOOT WIND TUNNEL**

Model Propulsion Air System Upgrade

- 5 Stage Air Compressor
- System Components
- Cooling Tower



Free Flight Model Test



Tunnel Flow Schematic

- Survey Equipment Upgrade**
- Repair Upgrade Flow Survey Carriage

FIGURE 2

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Repairs to Tunnel Shell, Unitary Plan Wind Tunnel

INSTALLATION: Langley Research Center

FY 1991 CoF Estimate: \$2,700,000

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$162,000	\$ ---	\$162,000
Capitalized Investment.....	---	<u>34,449,876</u>	<u>34,449,876</u>
Total.....	<u>\$162,000</u>	<u>34,449,876</u>	<u>\$34,611,876</u>

SUMMARY PURPOSE AND SCOPE:

This project is part of the NASA Aeronautical Facilities Revitalization Program and provides for repairs to approximately 1,800 linear feet of defective welds in the tunnel shell of the Unitary Plan Wind Tunnel at Langley Research Center (LaRC). The proposed repairs will correct the most serious conditions that exist at this time. The work required by this project includes: removal of asbestos insulation, removal of weld metal containing unacceptable indications; rewelding of the tunnel shell; radiographic examination of the new welds; and reinsulation of repaired areas.

PROJECT JUSTIFICATION:

Langley's Unitary Plan Wind Tunnel is one of the busiest wind tunnels at the Center, averaging 800 hours of research usage per year. It is a closed-circuit, variable-pressure tunnel used for research on civil and military aircraft and for advanced development of space transportation systems. This facility operates in the supersonic mode at Mach numbers ranging from 1.5 to 4.63. Normal operating pressures range from 0.1 atmosphere to 10 atmospheres.

Highly stressed portions of the Unitary Plan Wind Tunnel shell have been inspected under LaRC's Recertification Program. Numerous welds have been identified with unacceptable indications, although they have not yet reached their critical flaw size. Repair of the most serious of these indications is essential to allow continued supersonic research on critical national programs for advanced aircraft and space transportation systems.

IMPACT OF DELAY:

Delaying the necessary repairs to the tunnel shell may result in continued growth of the known indications to their critical flaw size. Under these circumstances, the facility may have to severely limit its annual usage, operate at lower pressures, or completely shut down operations. Any of these alternatives would delay essential supersonic research and jeopardize critical national programs.

PROJECT DESCRIPTION:

This project will repair approximately 1,800 linear feet of welds in the Unitary Plan Wind Tunnel's shell that have been found to contain unacceptable indications through non-destructive examination performed under LaRC's Recertification Program. The work required includes: removal of asbestos insulation; removal of weld metal containing unacceptable indications; rewelding of tunnel shell; radiographic examination of the new welds; and reinsulation of repaired areas.

PROJECT COST ESTIMATE: In-house engineering estimate.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$2,700,000</u>
Shell Repairs.....	LF	1,800	1,500	2,700,000
Total.....				<u>\$2,700,000</u>

LIST OF RELATED GRAPHICS:

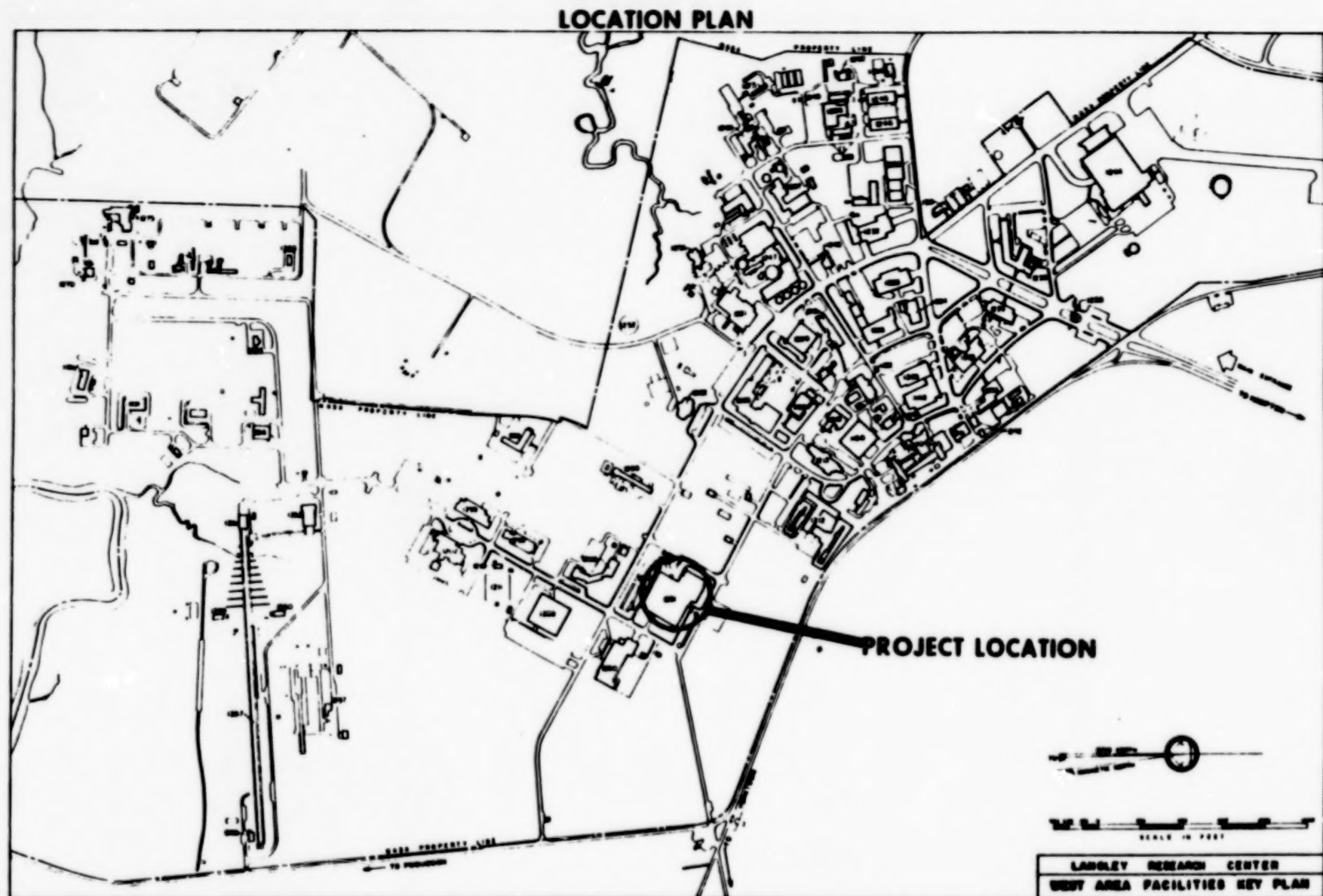
Figure 1 - Location Plan Figure 2 - System Schematic

OTHER EQUIPMENT SUMMARY: None

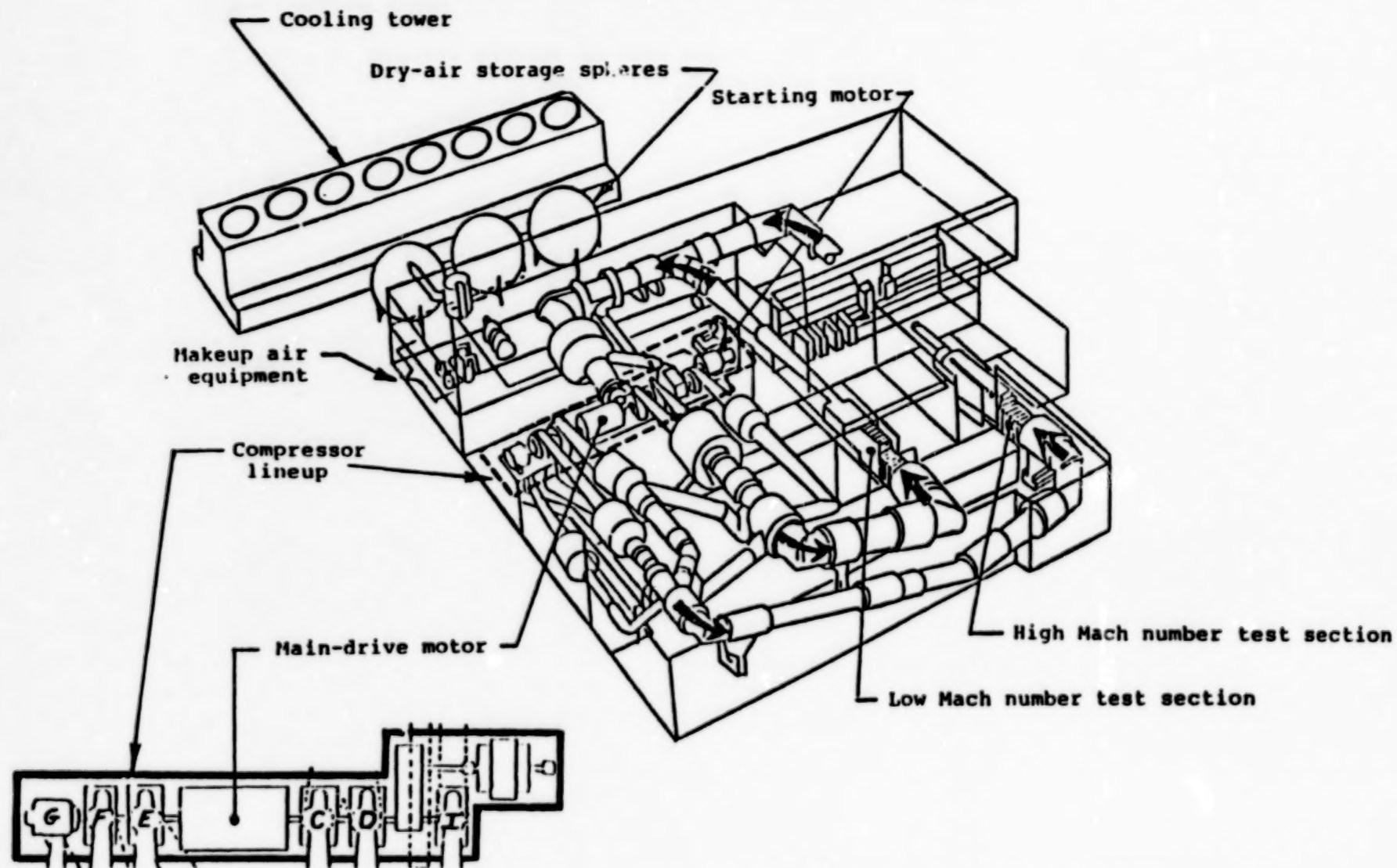
FUTURE CoF ESTIMATED FUNDING TO COMPLETE THIS PROJECT:

As further recertification examination is conducted, additional weld replacement may be required in a future project.

**LANGLEY RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATE
REPAIRS TO THE TUNNEL SHELL, UNITARY PLAN WIND TUNNEL**



LANGLEY RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATE
REPAIRS TO THE TUNNEL SHELL, UNITARY PLAN WIND TUNNEL



SCHEMATIC OF THE UNITARY PLAN WIND TUNNEL

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Rehabilitation of Central Air System

INSTALLATION: Lewis Research Center

FY 1991 CoF Estimate: \$7,900,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project.

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$822,000	\$ 2,400,000	\$ 3,222,000
Capitalized Investment.....	---	<u>30,300,000</u>	<u>30,300,000</u>
Total.....	<u>\$822,000</u>	<u>\$32,700,000</u>	<u>\$33,522,000</u>

SUMMARY PURPOSE AND SCOPE:

This project is part of the NASA Aeronautical Facilities Revitalization Program and provides for the rehabilitation and modification of the Lewis Research Center (LeRC) Central Air System. The system is more than thirty years old and has been in continual use supporting research in the 10X10 Supersonic Wind Tunnel, the 8X6/9X15 Supersonic Wind Tunnel, Icing Research Tunnel, Propulsion Systems Laboratory, Propulsion Lift Facility, and various test cells in the Engine Research Building Complex. The facilities supported by the central air systems represent the core of NASA's aeronautical propulsion research capability and are heavily scheduled with current and future research programs. The existing air system is deteriorating, becoming unreliable and unsafe.

PROJECT JUSTIFICATION:

This project will assure safe and reliable operation of the Central Air System necessary for continued support of aeronautical propulsion research. Specific justification for each element follows:

A. Rehabilitation of the 40 psig and 150 psig central air systems is required to assure safe and reliable operations of these systems. The rotors in the 40 psig and 150 psig compressors were fabricated more than thirty years ago. Since then, the rotor vanes have developed numerous cracks varying in size from 1/16 inch to 2 inches. The cracks can cause catastrophic failure of the system, resulting in the possible loss of life and excessive downtime of the system.

B. Rehabilitation of the drive motor control system is required to assure continued and reliable control of the Central Air System rotating machinery. The existing control system is based on outdated vacuum tube technology, no longer manufactured, with parts difficult to locate and expensive to obtain.

C. Rehabilitation of controls interface is required to provide reliable and adequate data rate between the Master Station located in the Central Control Building and the remote sensors and actuators controlling compressors, exhausters, valves and all auxiliary equipment. Additionally, replacement parts for the existing system are no longer available.

D. The structural repairs to the Altitude Exhaust System are required to bring sections of this system into compliance with National Piping Code Standards. The piping components in this project have been determined through the Recertification Program to have severely deteriorated piping and supports, and overstressed connections. The repairs in this project will enable the return to full utilization of the Altitude Exhaust System.

IMPACT OF DELAY:

Delay of this project will significantly increase the risk of unscheduled and lengthy shutdown of one or more major aeronautical research facilities due to failure of any of the above systems. The current and planned schedule of propulsion testing is dependent on a high degree of integrity and availability of the research facilities and the central air systems. Failure of these systems would result in major delays and disruption of research schedules. Delay of this project will also increase the probability of personnel injury because of equipment failure.

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PROJECT DESCRIPTION:

This project will rehabilitate the major compressors in the Central Air System. Work includes: replacement of seven rotors in the Group I Compressors; rehabilitation of the drive motor control systems; rehabilitation of the controls interface; structural repairs to the utility tunnel; replacement of altitude exhaust piping and; installation of a tie-line to increase testing capabilities of the system. Other work includes miscellaneous mechanical, structural, electrical and control modifications.

PROJECT COST ESTIMATE: Based on a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$7,900,000</u>
Rehab 40 psig and 150 psig Central Air System...	LS	---	---	5,489,000
Rehab Electrical Control System.....	LS	---	---	1,044,000
Rehab Controls Interface.....	LS	---	---	695,000
Repair Altitude Exhaust System.....	LS	---	---	<u>672,000</u>
Total.....				<u>\$7,900,000</u>

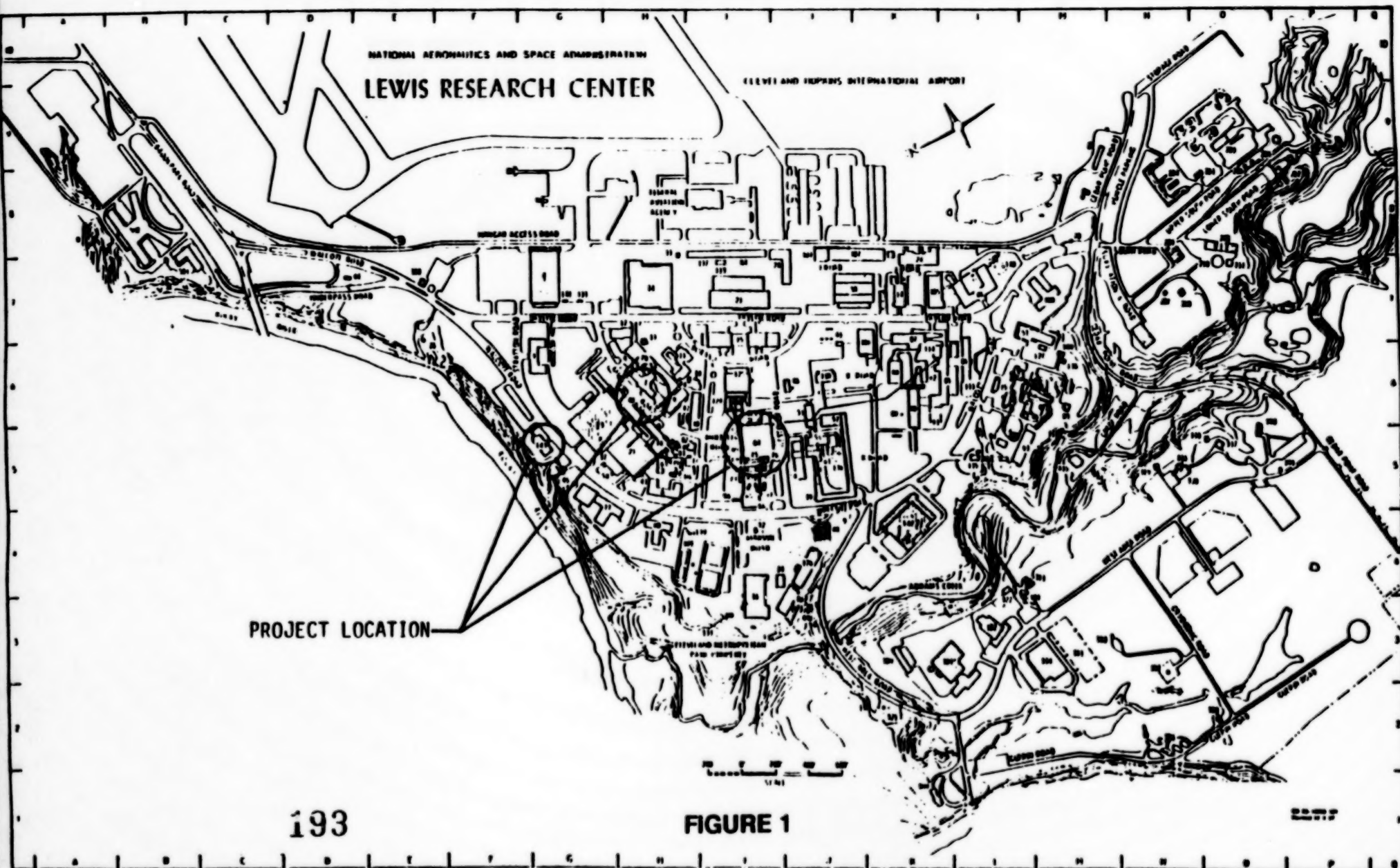
LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Central Air Equipment Building

OTHER EQUIPMENT SUMMARY: None

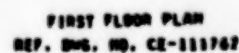
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

**LEWIS RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATES
REHABILITATION OF CENTRAL AIR SYSTEM**



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FIGURE 1



2

25 0 75 0
SCALE 1" = 25' - 0"
CF 8-20

FIGURE 2

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Rehabilitation of Propulsion Systems Laboratory

INSTALLATION: Lewis Research Center

FY 1991 CoF Estimate: \$6,000,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$480,000	---	\$ 480,000
Capitalized Investment.....	---	<u>\$19,797,000</u>	<u>19,797,000</u>
Total.....	<u>\$480,000</u>	<u>\$19,797,000</u>	<u>\$20,277,000</u>

SUMMARY PURPOSE AND SCOPE:

This project is part of the NASA Aeronautical Facilities Revitalization Program and provides for the rehabilitation and modification of the Propulsion Systems Laboratory (PSL). This project is necessary because of obsolescence of critical systems, accelerated deterioration of facility components, the effects of the hostile environment of engine exhaust on the test facilities, and exposure to weather. New programmatic requirements make it necessary to restore this facility to full operation.

PROJECT JUSTIFICATION:

This project is required to assure safe and reliable operation of the Propulsion Systems Laboratory. Specific justification for each element follows:

- A. Rehabilitation and modifications to the thrust measuring system in Cell 3 are required to enable PSL to meet the requirements for testing advanced aeropropulsion systems. The existing system is capable of testing only axial thrust propulsion systems. Replacement of this system with an integral multi-degree-of-freedom thrust measuring system will enable the facility to accurately measure the performance of multi-function deflected thrust nozzles for advanced tactical aircraft. All research programs scheduled in Cell 3 for the next decade will involve such advanced exhaust systems.
- B. Rehabilitation of the combustion air and exhaust valves is required to provide continued safe and reliable operation of the facility and for dynamic control of the simulated altitude conditions. Constant cycling over the past 20 years has caused severe deterioration of these valves and they no longer operate reliably.
- C. Rehabilitation of the facility control system is required to provide efficient and accurate simulation of the test environment. The existing control system is based on outdated vacuum tube technology and is not able to provide the facility response needed to control the rapidly changing test conditions needed to simulate advanced tactical aircraft maneuvers. The replacement of this control system with a new distributed control system will enable the PSL to meet requirements for advanced aeropropulsion technology development.
- D. Rehabilitation of the combustion air pressure and temperature supply systems is required to assure the integrity of major elements of the two systems which are experiencing rapid degradation due to exposure to the operating environment and weather. The modifications will provide higher pressure and temperature air for simulation of higher Mach numbers and fan discharge conditions for the testing of core engines.
- E. Rehabilitation of the exhaust cooler support system is required to assure the integrity of various critical portions of the exhaust collectors and exhaust cooler support equipment which have experienced accelerated deterioration. The portions of the facility downstream of the engine exhaust operate in an extremely hostile environment where temperatures can exceed 3000°F.

IMPACT OF DELAY:

Delay of this project will significantly increase the risk of unscheduled and lengthy shutdown of NASA's only altitude simulation facility for full-scale propulsion systems research. Completion of this work will assure the continued safe and reliable operation of this facility necessary to accomplish scheduled programs in hypersonic propulsion, thrust vectoring/reversing nozzle, and advanced augmentor and nozzle systems research.

PROJECT DESCRIPTION:

The work includes rehabilitation and modification of the following:

- A. PSL-3 thrust measurement system, to provide: multi-degree-of-freedom capability; increased space utilization of aft portion of tank; and auto calibration capability;
- B. Combustion air control valves and primary isolation of altitude exhaust header by installing an isolation valve and operator and a vent between isolation and existing valves;
- C. Facility control systems providing new distributed controls for auxiliary systems, including heater engines, cooling tower water, and fuel;
- D. Combustion air pressure and temperature supply systems by increasing Mach number capability and repairing the atmospheric inlet silencer, J57 heat exchanger and muffler, gas fired air heater, and acoustic treatment of Building 124; and
- E. Exhaust cooler support systems by providing new water cooled exhaust collector adapters and replacing the radiation shield with purge and piping. The project will repair the cooling water scavenger pump system and replace the spray and cooling tower return pumps.

PROJECT COST ESTIMATE: Based on a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$6,000,000</u>
Rehab & Mod PSL-3 Thrust Measurement System...	LS	---	---	1,200,000
Rehab Combustion Air & Exhaust Valves.....	LS	---	---	1,200,000
Rehab Facility Control Systems.....	LS	---	---	600,000
Rehab Combustion Air Pressure & Temperature Supply Systems.....	LS	---	---	2,200,000
Rehab & Mod Exhaust Cooler Support Systems....	LS	---	---	<u>800,000</u>
Total.....				<u>\$6,000,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Rehabilitation of Combustion Air Valves
Figure 3 - Primary Cooler Heat Exchanger

OTHER EQUIPMENT SUMMARY: None

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

LEWIS RESEARCH CENTER

CLEVELAND HOPKINS INTERNATIONAL AIRPORT

PROJECT LOCATION

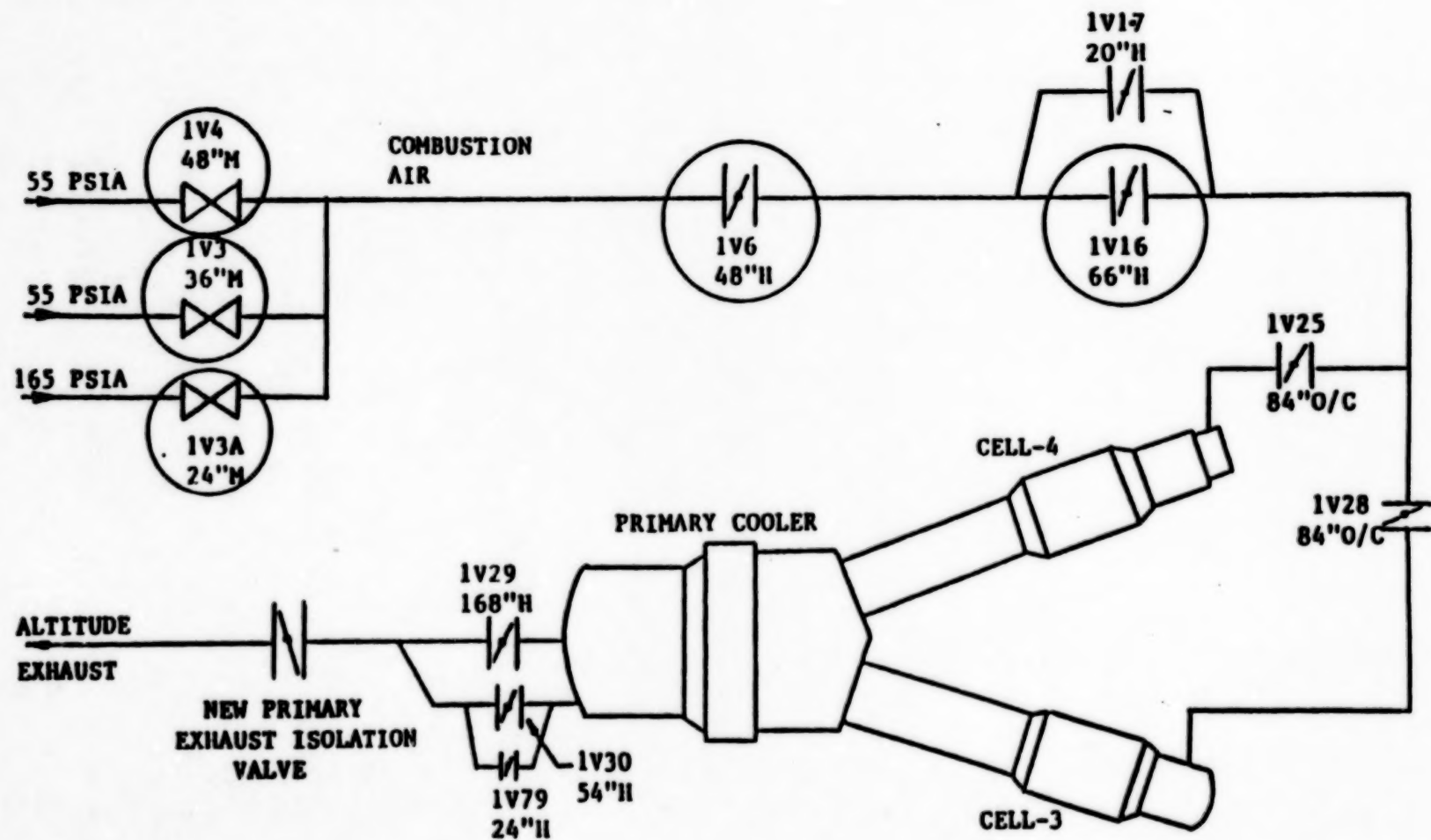
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FIGURE 1

LOCATION PLAN

LEWIS RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATES
REHABILITATION OF PROPULSION SYSTEMS LABORATORY

REHABILITATION OF COMBUSTION AIR VALVES



M - MOTOR DRIVEN
H - HYDRAULIC
O/C - OPEN or CLOSED
X - GATE / - BUTTERFLY

FIGURE 2

LEWIS RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATES
REHABILITATION OF PROPULSION SYSTEMS LABORATORY
PRIMARY COOLER HEAT EXCHANGER

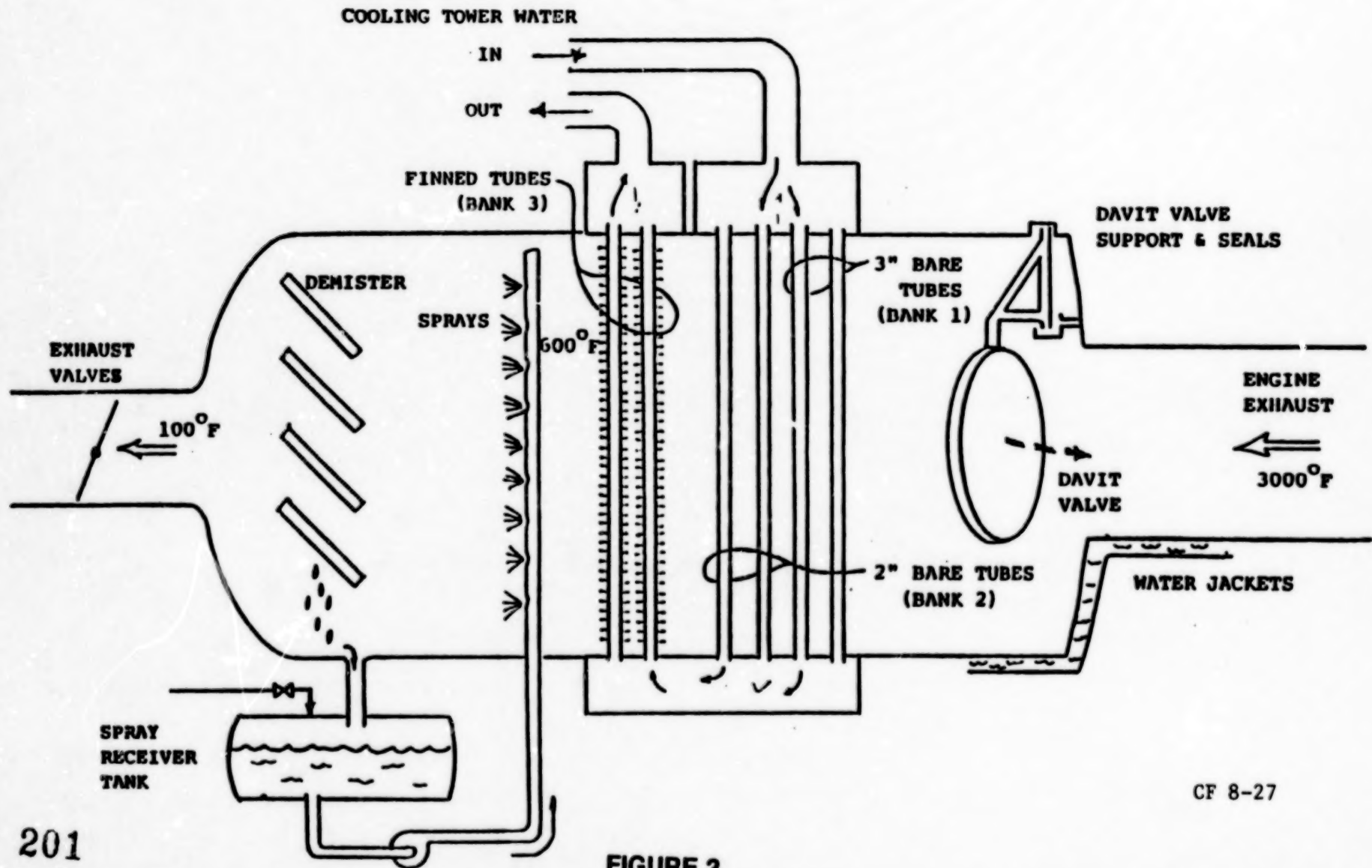


FIGURE 3

CF 8-27

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

SUMMARY

DRYDEN FLIGHT RESEARCH FACILITY

	<u>Amount</u>	<u>Page</u>
	(Dollars)	No.
<u>Office of Aeronautics and Space Technology:</u>		
Construction of Liquid Hydrogen Structural Test Facility.....	18,800,000	CF 9-1
Rehabilitation and Modification of the Electrical Distribution System.....	<u>4,000,000</u>	CF 9-7
Total.....	<u>22,800,000</u> =====	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Construction of Liquid Hydrogen Structural Test Facility

INSTALLATION: Dryden Flight Research Facility

FY 1991 CoF Estimate: \$18,800,000

LOCATION OF PROJECT: Edwards Air Force Base, Kern County, CA

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project.

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF funding.....	\$1,300,000	---	\$1,300,000
Capitalized investment.....	---	---	---
Total.....	<u>\$1,300,000</u>	<u>---</u>	<u>\$1,300,000</u>

SUMMARY PURPOSE AND SCOPE:

This project provides the capability to perform combined load and thermal static tests of structural components containing liquid hydrogen (LH2). The development of various hydrogen tank concepts and actively cooled structures is required to support NASA's renewed commitment to hypersonic research, including the development of the National Aerospace Plane (NASP). The test complex will consist of a large test cell area, LH2 storage and piping, high pressure gas storage area, a test control center, a support building, utilities, cryogenic systems, and loading and heating systems.

PROJECT JUSTIFICATION:

The Liquid Hydrogen Structural Test Facility (LHSTF) is required to support NASA structures research and technology, hypersonic vehicle structural systems development and certification requirements, and national programs such as the NASP and Advanced Launch Systems (ALS) Programs. Developing and qualifying the airframe design will involve combined loads and thermal static structural testing of components containing LH2. No capability exists in the U.S. for hot structures testing of large scale hydrogen-cooled structural components including control capability for nonlinear thermal load profiles and high capacity instrumentation. This test facility will support flight test/research by providing a ground test facility needed to develop the hydrogen-cooled structures measurement systems and structural flight certification requirements. The hydrogen-cooled structures will also serve as fuel conditioning systems and will require sophisticated pumping and control systems for effective operation throughout the flight envelope. A number of other factors make Dryden the logical location for the LHSTF. The existing Flight Loads Research Facility (FLRF) at Dryden is one of very few facilities capable of conducting combined load and heating flight simulation tests of large hypersonic structural components. Also, Dryden's remote location on the edge of Rogers Dry Lake makes it an ideal location from a safety and security standpoint.

IMPACT OF DELAY:

The development of flight measurement systems, control systems, and control laws is a long lead time research and development process and must precede the construction of the flight vehicle. The tests of the hydrogen structures concepts will provide data for the development of vehicle certification criteria and factors of safety for design. Because this facility is required to ensure safety of flight, delay leads to greater risk for each flight, smaller steps for envelope expansion, and significant risk to meeting flight program mission objectives.

PROJECT DESCRIPTION:

This project consists of approximately 17,500 square feet of facilities and approximately 144 fenced acres, and will be located north of the Dryden complex to maintain the required distance for LH2 safety but be close enough to the FLRF for efficient operation. The LHSTF consists of a 4000-square-foot test control center, a 2900 square foot data acquisition/power control building, 8,200 square feet of support buildings, LH2 and high pressure gas storage and piping, lighting, fencing, and a guard house. Power will be provided by a 20 megawatt substation at the site with 34 kilovolt power lines being run back to the Rosamond Boulevard switching station.

PROJECT COST ESTIMATE: Based on a current Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	-----	---	---	<u>\$18,800,000</u>
Site Development.....	LS	---	---	1,370,000
Utilities.....	LS	---	---	5,300,000
Building and Structures.....	LS	---	---	7,540,000
Test Power Equipment.....	LS	---	---	1,030,000
LH2/LN2 Systems.....	LS	---	---	2,910,000
High Pressure Gas System.....	LS	---	---	650,000
Total.....				<u>\$18,800,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Site Plan Figure 3 - Testing Complex

OTHER EQUIPMENT SUMMARY:

Data acquisition and control systems estimated to cost \$1.4M will be located at this facility.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

**DRYDEN FLIGHT RESEARCH FACILITY
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF THE LIQUID HYDROGEN STRUCTURAL TEST FACILITY**

LOCATION PLAN

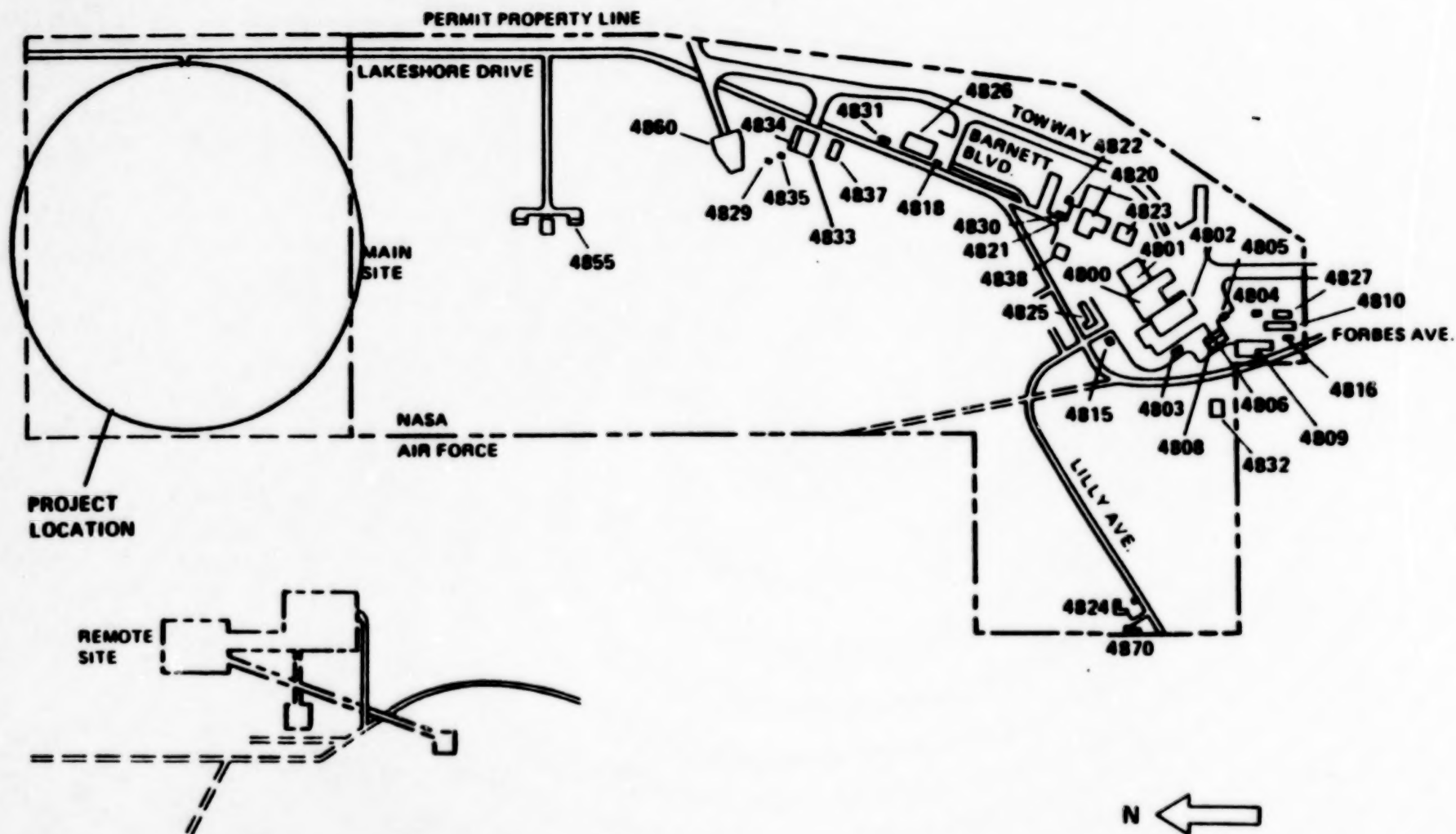
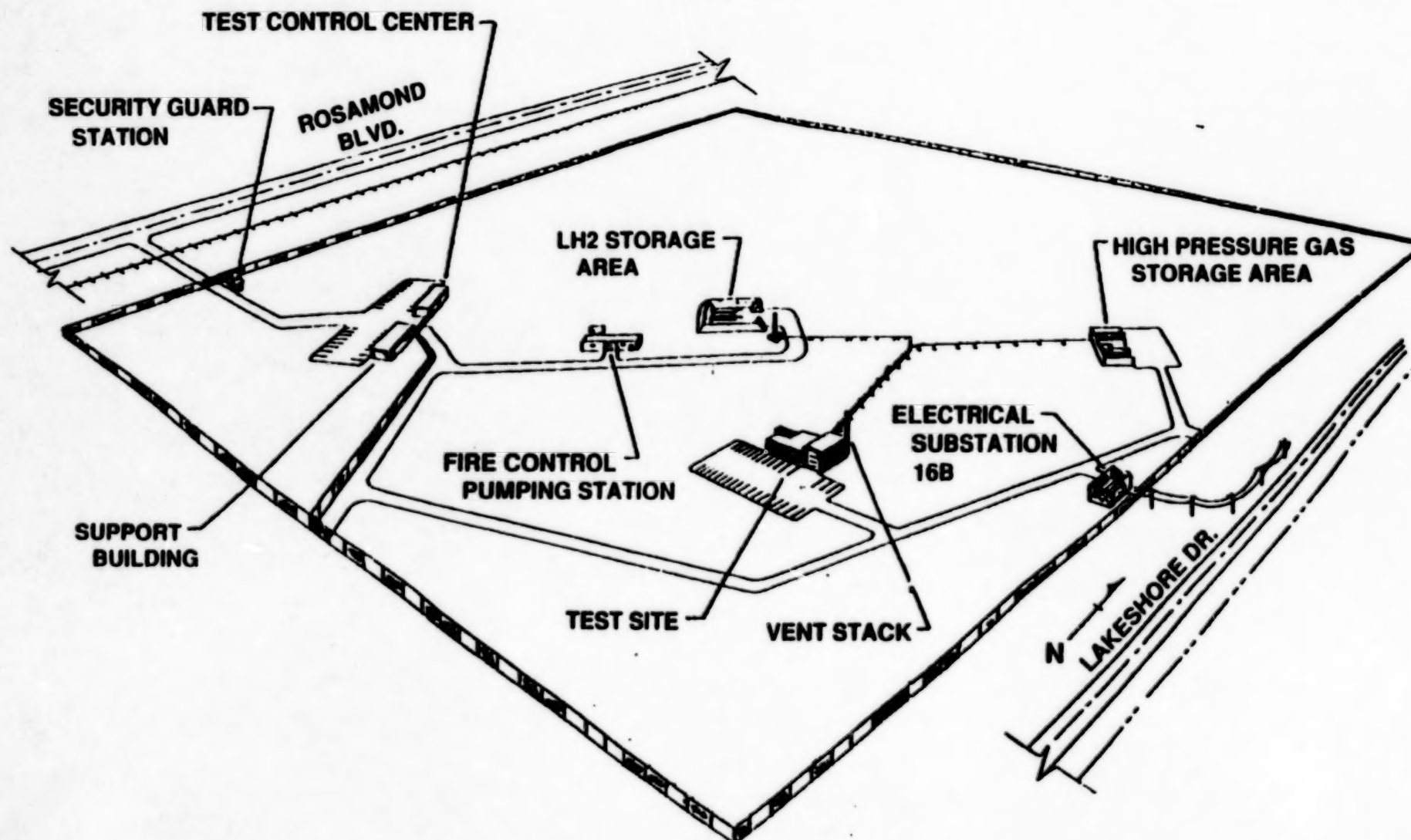


FIGURE 1

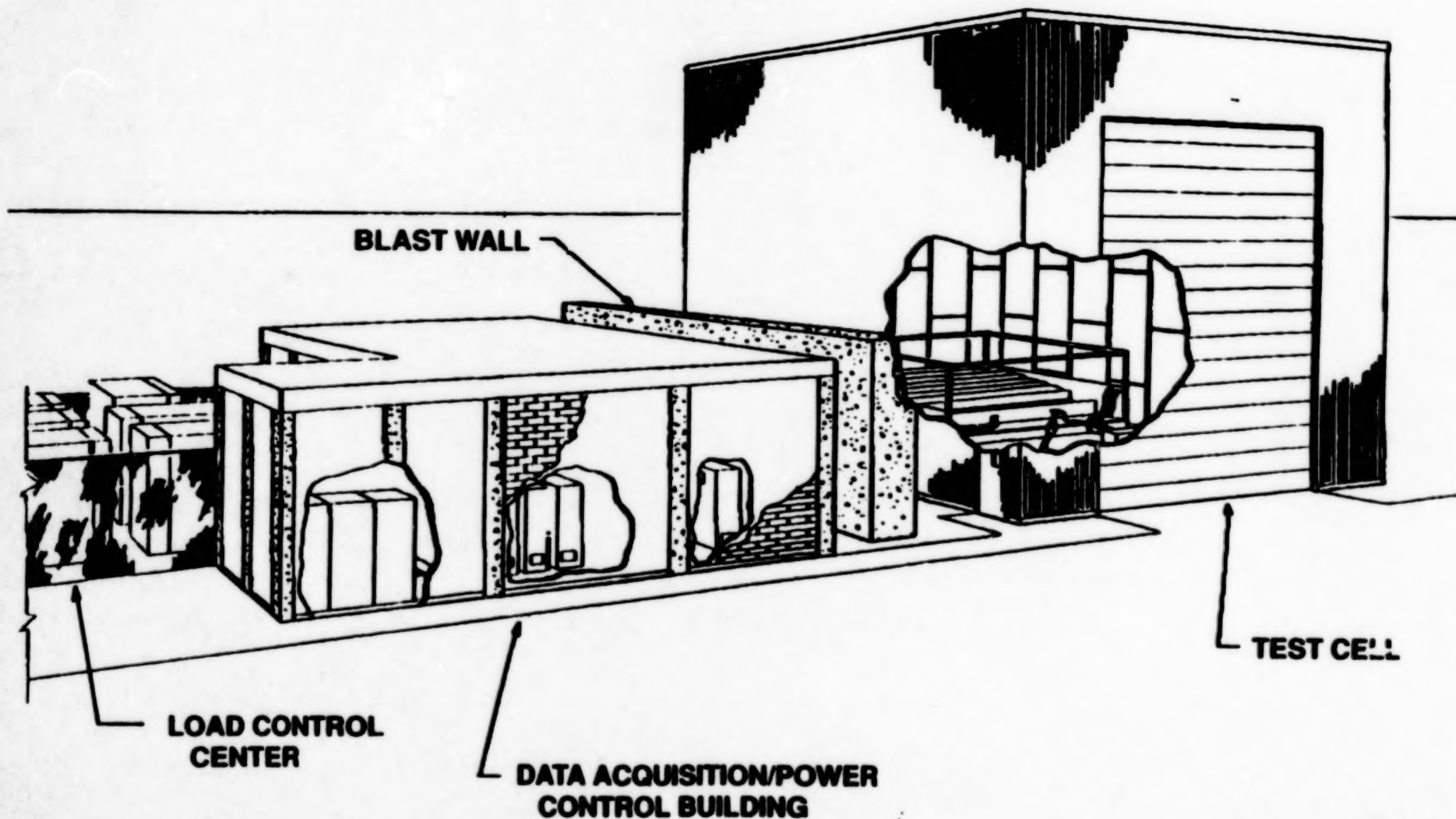
**DRYDEN FLIGHT RESEARCH FACILITY
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF THE LIQUID HYDROGEN STRUCTURAL TEST FACILITY**

SITE PLAN



**DRYDEN FLIGHT RESEARCH FACILITY
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF THE LIQUID HYDROGEN STRUCTURAL TEST FACILITY**

TESTING COMPLEX



CF 9-6

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Rehabilitation and Modification of the Electrical Distribution System

INSTALLATION: Dryden Flight Research Facility

FY 1991 CoF Estimate: \$4,000,000

LOCATION OF PROJECT: Edwards AFB, Kern County, California

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project.

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF funding.....	\$433,000	---	\$433,000
Capitalized investment.....	---	\$420,265	420,265
Total.....	<u>\$433,000</u>	<u>\$420,265</u>	<u>\$853,265</u>

SUMMARY PURPOSE AND SCOPE:

This project will provide a new 34.5 kV switching station linked to the Southern California Edison (SCE) power grid, an expanded 34.5/12 kV distribution system, and a dual 12 kV primary distribution system. In addition, obsolete equipment will be replaced, the grounding system upgraded, and corrected relaying and protective equipment will be installed. The existing Air Force power supply is unreliable with frequent outages and the Air Force power requirements will use all future spare capacity. The Air Force is currently planning upgrades to their system. The proposed upgraded system for Dryden will provide increased reliability, flexibility and improved voltage performance. It does not duplicate any of the planned Air Force improvements.

PROJECT JUSTIFICATION:

This project is required to provide an adequate, reliable, and maintainable electric power distribution system. The existing system is subject to massive outages from single-point failures, has not been designed for maintainability, and has other design flaws that reduce its reliability and safety. The existing Dryden electrical distribution system was constructed in 1954 as an adjunct to the Edwards Air Force Base (EAFB) distribution system. It has been modified since that time on a piecemeal basis. The end result is a system without backup, subject to interruptions and voltage reductions due to minor problems associated with Air Force-owned and -operated equipment, and is extremely difficult to maintain without shutting down power to major parts of Dryden. Dryden will realize many benefits from upgrading its electrical system: (1) improved voltage performance by raising and standardizing the distribution voltage; (2) improved reliability by reducing outages; and (3) improved flexibility in regards to additional capacity and routing of power.

IMPACT OF DELAY:

This project must be done now because new Air Force facilities at EAFB coming on line in the early 1990's will require a major increase in electrical supply thereby exacerbating the NASA problem. The current EAFB power distribution system is expected to reach its capacity limits at that time, and will require curtailment of power to some parts of the base so that flight operations may be adequately supported. If this project is not provided, growth of Dryden activities will be halted and existing services and ongoing activities may also be subject to reductions.

PROJECT DESCRIPTION:

A new 34.5 kV switching station will be constructed at North Edwards, linked to the EAFB switching station. This switching system will be designed and located so that it can be directly connected to future expansions of the SCE Edwards Station Transformer. The existing 34.5 kV distribution lines serving Dryden will be used and a new 34.5 and 12.5 kV lines will be constructed to provide Dryden with a system as shown in Figure 2. The existing substation #16 will be upgraded to provide redundancy to a 20 MVA level and to eliminate equipment containing polychlorinated biphenyls (PCBs). A new 12.5 kV substation will be installed at Dryden's remote site, and a new dual circuit 12.5 kV distribution system will be provided at the main facility, primarily by pulling new wire in existing ducts. Spare duct banks, manholes and switches will be provided where necessary. Obsolete transformers and switchgear will be replaced, and fuses and switches will be repaired, replaced, or installed in appropriate locations. Instrumentation and metering will be provided, the grounding and protective relaying system will be upgraded, and automatic startup capabilities will be added to existing emergency generators.

PROJECT COST ESTIMATE: Based on a current planning study.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$4,000,000</u>
Dedicated 34.5 kV System.....	LS	---	---	1,160,000
Expansion of Substation 16.....	LS	---	---	1,175,000
Dual Primary System.....	LS	---	---	392,000
Replace Obsolete and Unsafe Equipment.....	LS	---	---	915,000
Upgrade of System Protection.....	LS	---	---	13,000
Emergency Generators and Metering.....	LS	---	---	345,000
<u>Equipment</u>	---	---	---	<u>---</u>
Total.....				<u>\$4,000,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Site Plan

OTHER EQUIPMENT SUMMARY: None.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

At the present time there are no requirements for future CoF funding.

**DRYDEN FLIGHT RESEARCH FACILITY
FISCAL YEAR 1991 ESTIMATES
REHABILITATION AND MODIFICATION OF THE ELECTRICAL DISTRIBUTION SYSTEM**

LOCATION PLAN

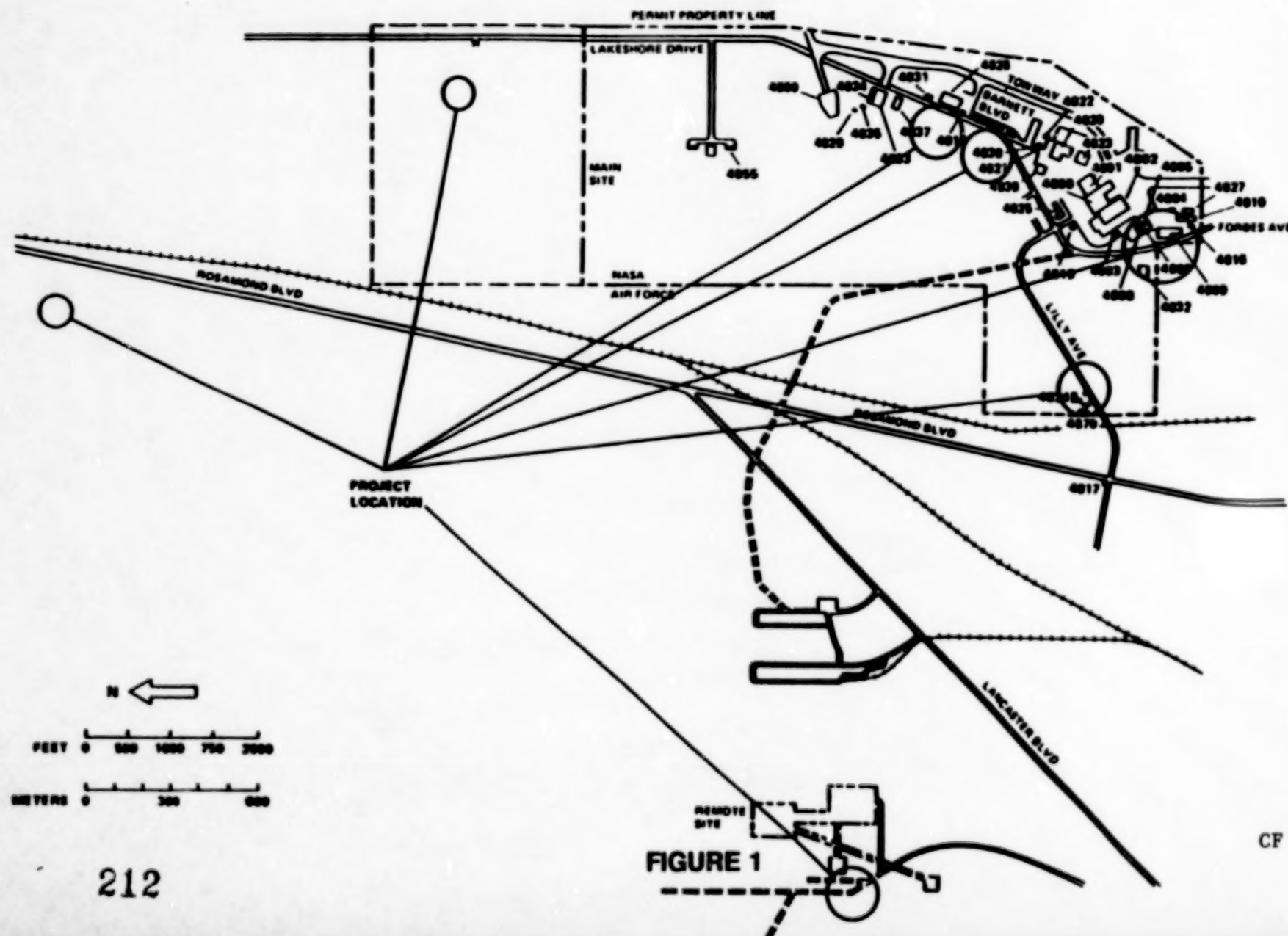


FIGURE 1

CF 9-10

**DRYDEN FLIGHT RESEARCH FACILITY
FISCAL YEAR 1991 ESTIMATES
REHABILITATION AND MODIFICATION OF THE ELECTRICAL DISTRIBUTION SYSTEM**

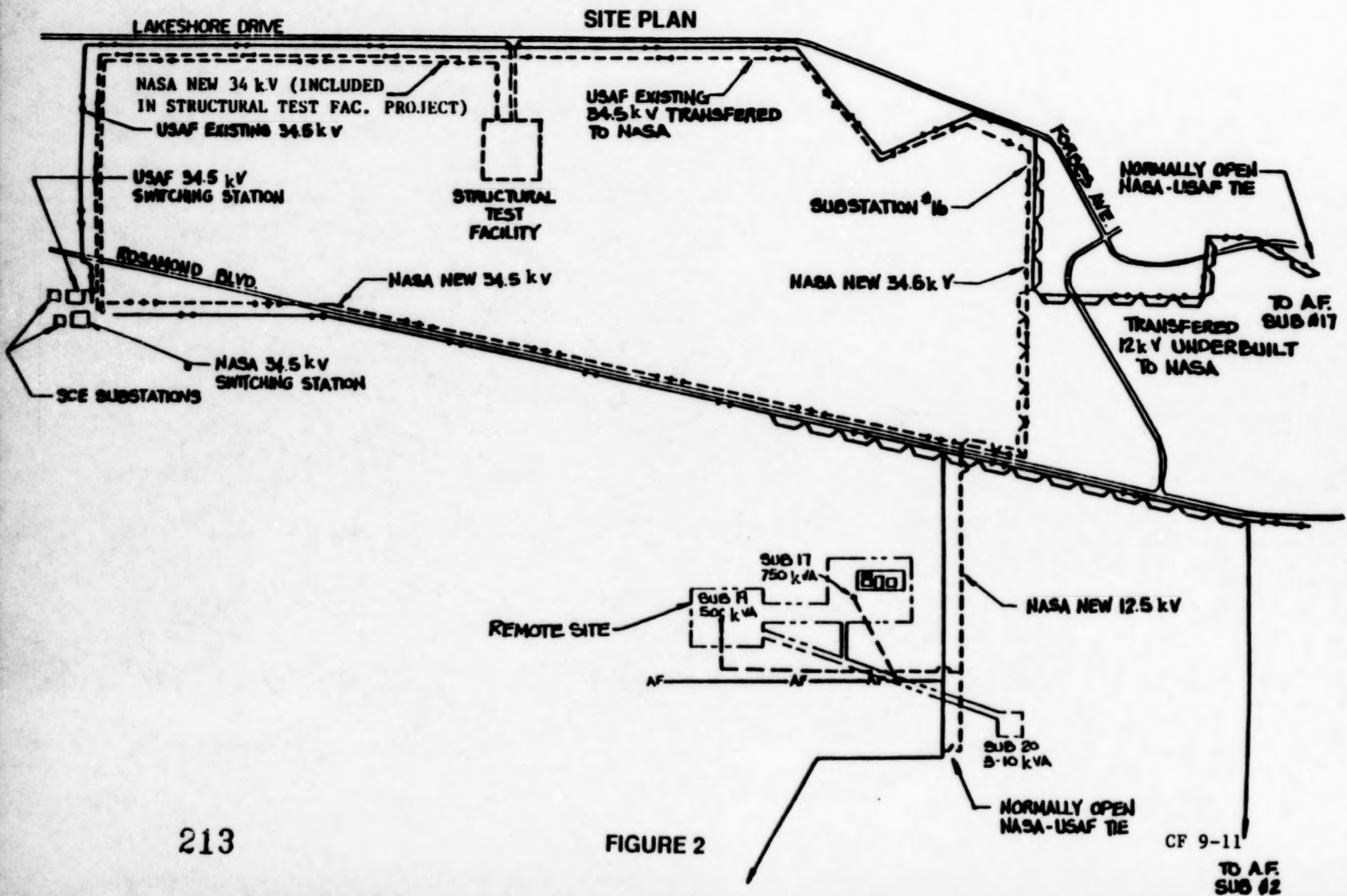


FIGURE 2

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

SUMMARY

LANGLEY RESEARCH CENTER

	<u>Amount</u>	<u>Page</u>
	(Dollars)	No.
<u>Office of Aeronautics and Space Technology:</u>		
Construction of Addition for Light-Alloy Research Laboratory.....	4,600,000	CF 10-1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Construction of Addition for Light-Alloy Research Laboratory

INSTALLATION: Langley Research Center

FY 1991 CoF Estimate: \$4,600,000

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$368,000	---	\$ 368,000
Capitalized Investment.....	---	<u>\$2,058,944</u>	<u>2,058,944</u>
Total.....	<u>\$368,000</u>	<u>\$2,058,944</u>	<u>\$2,426,944</u>

SUMMARY PURPOSE AND SCOPE:

This project will establish an integrated facility for light-alloy research. A two-story addition to the Fatigue and Fracture Research Laboratory (1205) will provide laboratories for surface analysis, innovative processing and joining techniques, and the capability for light-alloy and metal-matrix composite synthesis and development by deposition processes. Sensitive analysis equipment will be located on two floating concrete slabs to provide isolation from building and ground vibrations. A hazardous materials area will provide a safe environment for research on beryllium and similar toxic materials. A second-story addition that connects Building 1205 and Building 1148 will allow for additional capability in synthesis and development processing of thin-gauge light-alloy matrix composites.

CF 10-1

PROJECT JUSTIFICATION:

The development of advanced materials is a critical, enabling technology for structural requirements in nearly all future aerospace vehicles. Advanced aircraft and aerospace vehicles have spurred development of new material systems i.e., aluminum-lithium, titanium-aluminides, high-temperature alloys and metal-matrix composites. The light-alloy research and development program supports structural material requirements for subsonic and supersonic transports, hypersonic vehicles, and advanced space transportation systems.

Currently the majority of the metallic-materials research activity is conducted in 45-year-old Building 1148. It was originally built for the testing of aircraft and full-scale structural components. Over the past 45 years, test equipment and utilities have been added for materials research activities. These changes have resulted in inefficient operation and constrained research through fragmentation of materials activities and interferences among research disciplines, inadequate environmental control, limited space for expanding activities, and overtaxed utilities. The open configuration with essentially no acoustic damping also results in high noise levels. A new and more appropriate space is needed to conduct this research. The proposed additions to Building 1205 adjacent to Building 1148 will provide the needed space and controlled research environment to conduct timely materials research in support of growing programs. All materials research activities will then be integrated within enclosed laboratory areas with appropriate environmental and safety features for each materials discipline. LaRC has a unique situation not found in industry that can integrate aerodynamics, thermal structures, and material disciplines at a single location. Without a guaranteed large market, industrial research will not commit to high-risk research and development.

IMPACT OF DELAY:

Delay of this project will greatly slow the expanding light-alloy research and development programs, and will jeopardize the readiness of new structural materials to meet the needs of future aerospace vehicles. Research funds have been committed to upgrade current equipment and to purchase new equipment. However, program continuity and critical milestones for future NASA missions in subsonic, supersonic, and hypersonic aircraft and space transportation systems will be jeopardized unless additional laboratory space with adequate environmental control is provided.

PROJECT DESCRIPTION:

The project provides for the construction of a 19,000-square-foot, two-story addition to the south side of Building 1205 and a 3,000-square-foot second-floor addition that connects Buildings 1205 and 1148. The two-story addition will be divided into separate and enclosed discipline-oriented laboratories for materials research. Each laboratory will have independent environmental control. Distribution of laboratory gases and liquid nitrogen will be required. Two floating pads will be required on the first floor to isolate laboratories from building and ground vibrations. Two roll-up doors, 12- and 20-feet-wide, will be required

to provide full access to existing laboratory areas. The second-floor addition will require a controlled environment for the development of thin-gauge metal-matrix composites. In addition to normal utilities, laboratory gases, chilled water, and fume hoods with exhaust systems will be required. Parking spaces will be provided to replace those eliminated by the addition.

PROJECT COST ESTIMATE: Based on a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction.....</u>	---	---	---	<u>\$4,600,000</u>
Site Work.....	LS	---	---	165,000
Architectural/Structural.....	LS	---	---	1,510,000
Mechanical.....	LS	---	---	1,700,000
Electrical.....	LS	---	---	650,000
Case Work.....	LS	---	---	575,000
 Total.....				 <u>\$4,600,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Exterior and Floor Plans

OTHER EQUIPMENT SUMMARY: None.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None.

**LANGLEY RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATE
CONSTRUCTION OF ADDITION FOR LIGHT-ALLOY RESEARCH LABORATORY**

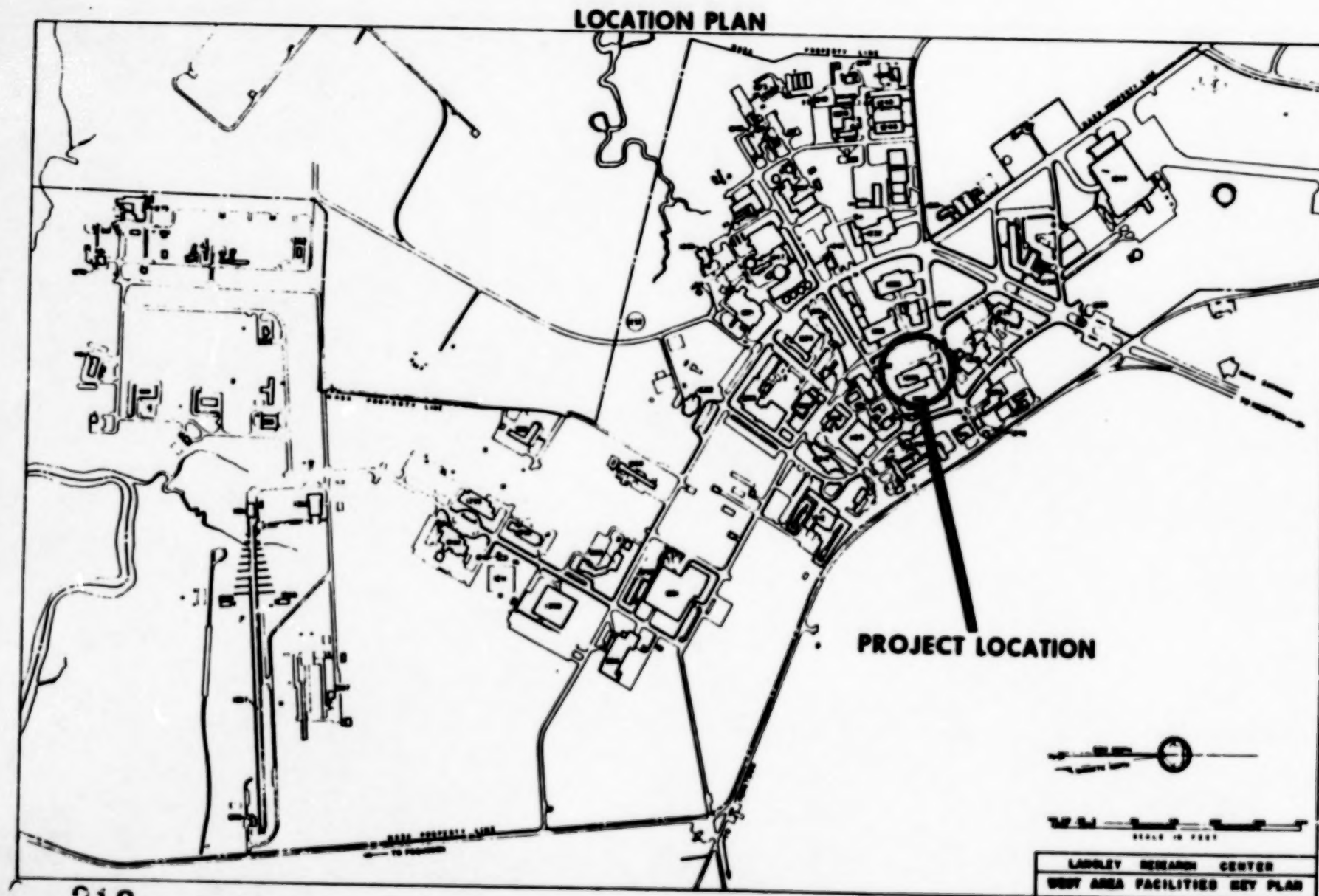
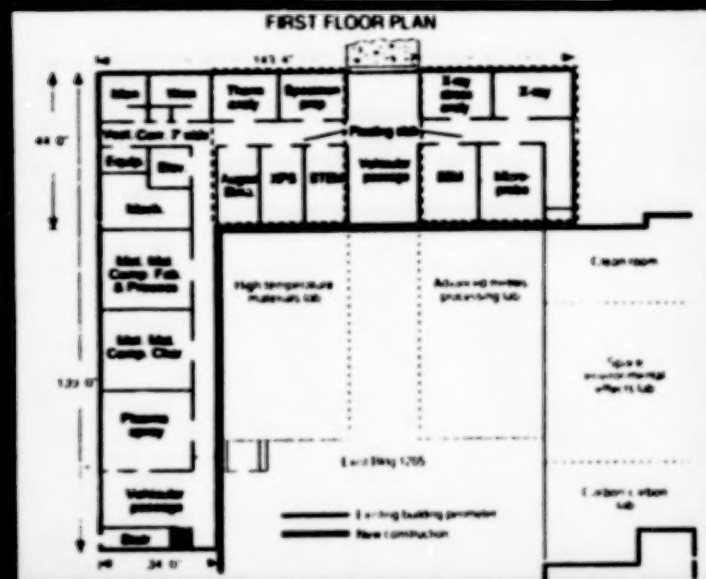


FIGURE 1

CF 10-4

Advanced Materials Development



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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

SUMMARY

LEWIS RESEARCH CENTER

	<u>Amount</u>	<u>Page</u>
	(Dollars)	No.
<u>Office of Space Science and Applications:</u>		
Construction of Space Experiments Laboratory.....	7,100,000	CF 11-1
<u>Office of Aeronautics and Space Technology:</u>		
Refurbishment of Electric Power Laboratory.....	8,900,000	CF 11-8
Total.....	16,000,000	
	=====	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Construction of Space Experiments Laboratory

INSTALLATION: Lewis Research Center

FY 1991 CoF Estimate: \$7,100,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Space Science and Applications

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$576,000	---	\$576,000
Capitalized Investment.....	---	<u>\$3,884,000</u>	<u>3,884,000</u>
Total.....	<u>\$576,000</u>	<u>\$3,884,000</u>	<u>\$4,460,000</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of a Space Experiments Laboratory (SEL) to support NASA's growing Microgravity Science and Applications and In-Space Research and Technology programs. This 36,000-square-foot addition to the existing Zero Gravity (Zero-G) facility will provide laboratories for microgravity science research, controlled environments for assembly, testing, and refurbishment of space flight experiments, and a Telescience Operations Center. Rehabilitation of the below grade systems of the Zero-G Facility is also included in this project.

PROJECT JUSTIFICATION:

Lewis Research Center (LeRC) has had a pioneering role in NASA's space experiments program. Included is microgravity research in the areas of materials, combustion, fluid physics and instrumentation. The program includes Microgravity Science and Applications and In-Space Research and Technology. The Microgravity Science and Applications program includes more than 40 definition grants and contracts to university and industry Principal Investigators, and significant in-house research efforts utilizing LeRC's unique microgravity facilities. Currently there are sixteen science flight experiments under development at LeRC. The In-Space Research and Technology program elements include: cryogenic fluid management; ion auxiliary propulsion systems; arc jet development and flight; fluid mechanics; spacecraft fire safety; materials processing, furnace development for Space Transportation Systems; and many other projects. LeRC also has lead responsibility for four Advanced Technology Development (ATD) and two Space Station facility development projects.

Work in support of the space experiment program is currently being carried out in twelve facilities and offices scattered across the Center. Consolidation of these laboratories and support areas in a dedicated facility would result in more efficient and effective utilization of personnel and resources. The available laboratory space is saturated making it extremely difficult to maintain the quality of experimental flight hardware, and leaving no means to accommodate the projected growth of this program. Additional program requirements of high bay clean rooms for the assembly and checkout of medium and large sized experiments cannot be met in the existing facilities at LeRC. The new Space Experiments Laboratory will provide the additional space necessary to accommodate current and projected program requirements, and enable the consolidation of program facilities.

IMPACT OF DELAY:

Without the SEL, Lewis will be seriously restricted in its ability to fulfill its commitment for an expanded space experiments program in the field of low-gravity research and development for Space Shuttle and Space Station hardware. The impact of delaying the construction of this facility would impose added costs and delay any basic research involving space hardware testing.

PROJECT DESCRIPTION:

This project will provide a new 36,000-square-foot building at the south end of the Zero Gravity Facility (110). It will contain 6,300 square feet of high bay area with a class 100,000 clean room rating to accommodate Spacelab pallet-size experiment and Space Station laboratory module ground-based activities. Associated with the highbay area will be four class 100,000 clean rooms totaling 2,800 square feet for preparation of flight electronic boxes and harnesses, flight mechanical subassemblies and controlled storage of flight hardware. In addition, a 450-square-foot computer/control room adjacent to the high bay area will

CF 11-2

be used to collect data from microgravity ground-based test laboratory experiments. Eight laboratory rooms totaling 4,550 square feet will be provided. Shipping and receiving, shop, offices, elevator, tool, ante room, conference, mechanical and electrical equipment, rest rooms, and supporting facilities will also be provided.

PROJECT COST ESTIMATE: The project cost estimate is based on a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$7,100,000</u>
Site Development.....	LS	---	---	595,000
Architectural/Structural.....	LS	---	---	3,260,000
Mechanical.....	LS	---	---	1,240,000
Electrical.....	LS	---	---	880,000
Below Grade Modifications to Shaft.....	LS	---	---	710,000
Crane Modifications.....	LS	---	---	180,000
Elevator.....	LS	---	---	105,000
Fire Protection/Alarm System.....	LS	---	---	130,000
 Total.....				 <u>\$7,100,000</u>

LIST OF RELATED GRAPHICS:

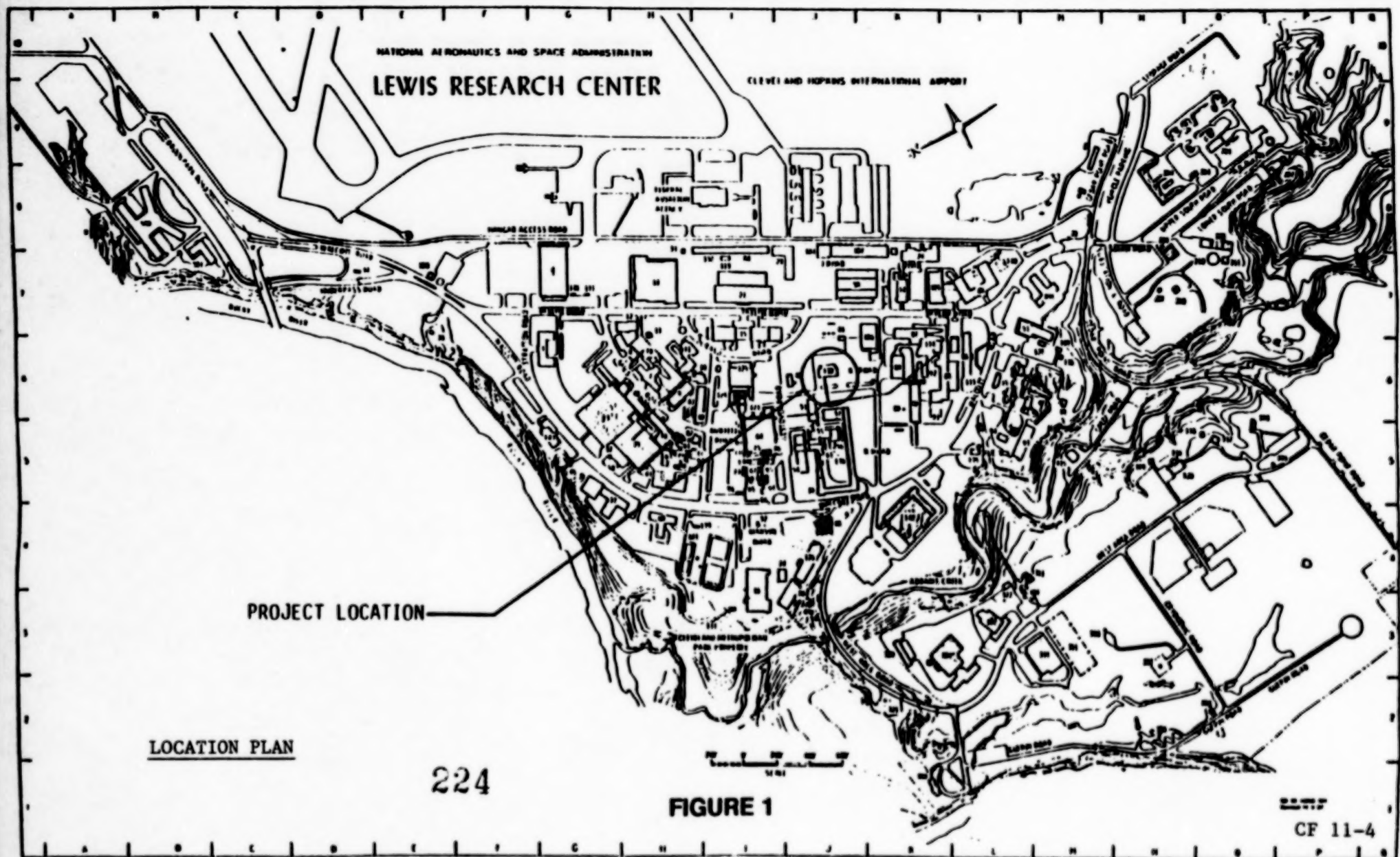
Figure 1 - Location Plan	Figure 2 - First Floor Plan
Figure 3 - Second Floor Plan	Figure 4 - Third Floor Plan

OTHER EQUIPMENT SUMMARY:

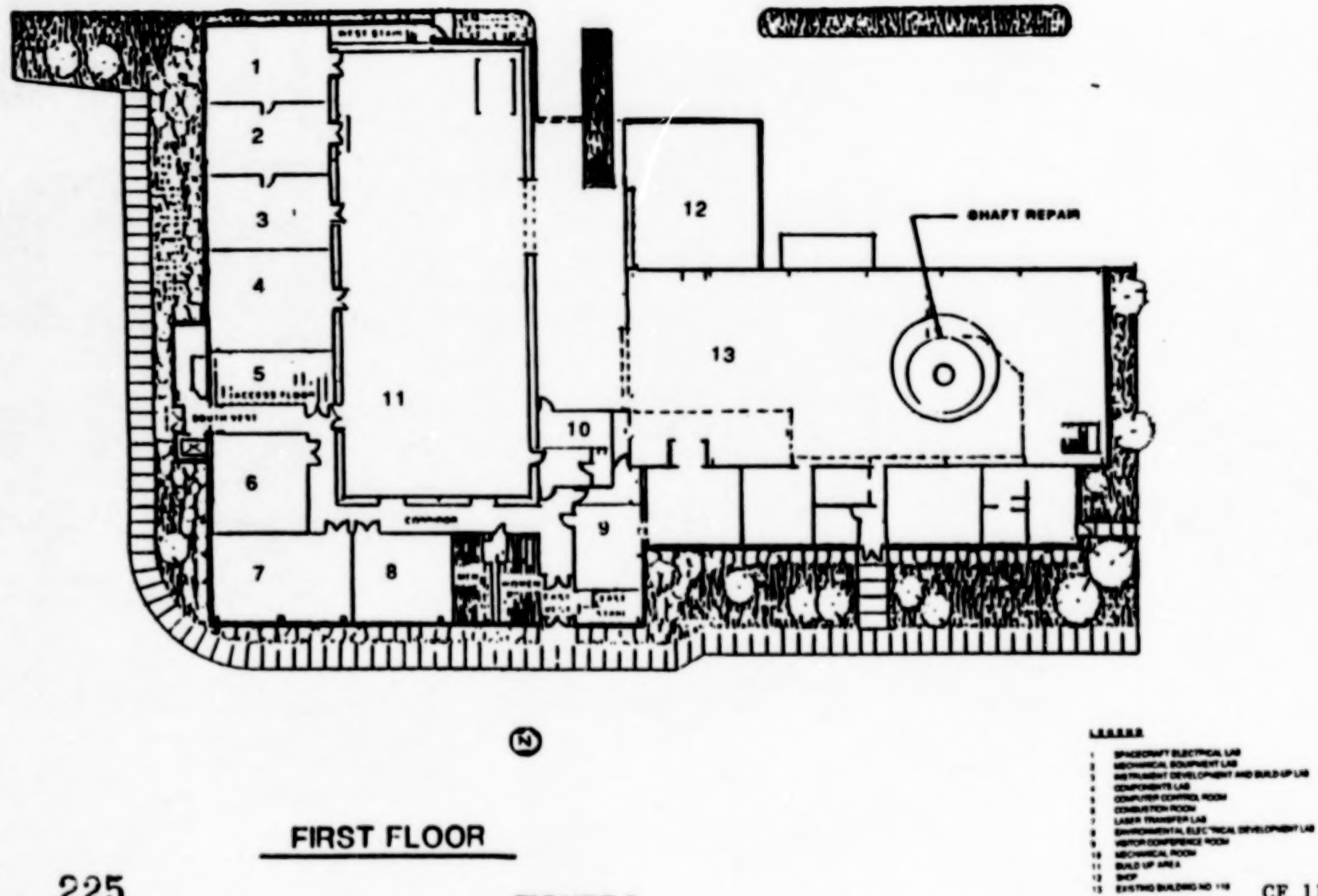
Existing equipment valued at approximately \$150,000 of research rig hardware will be incorporated into this project.

FUTURE ESTIMATED CoF FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

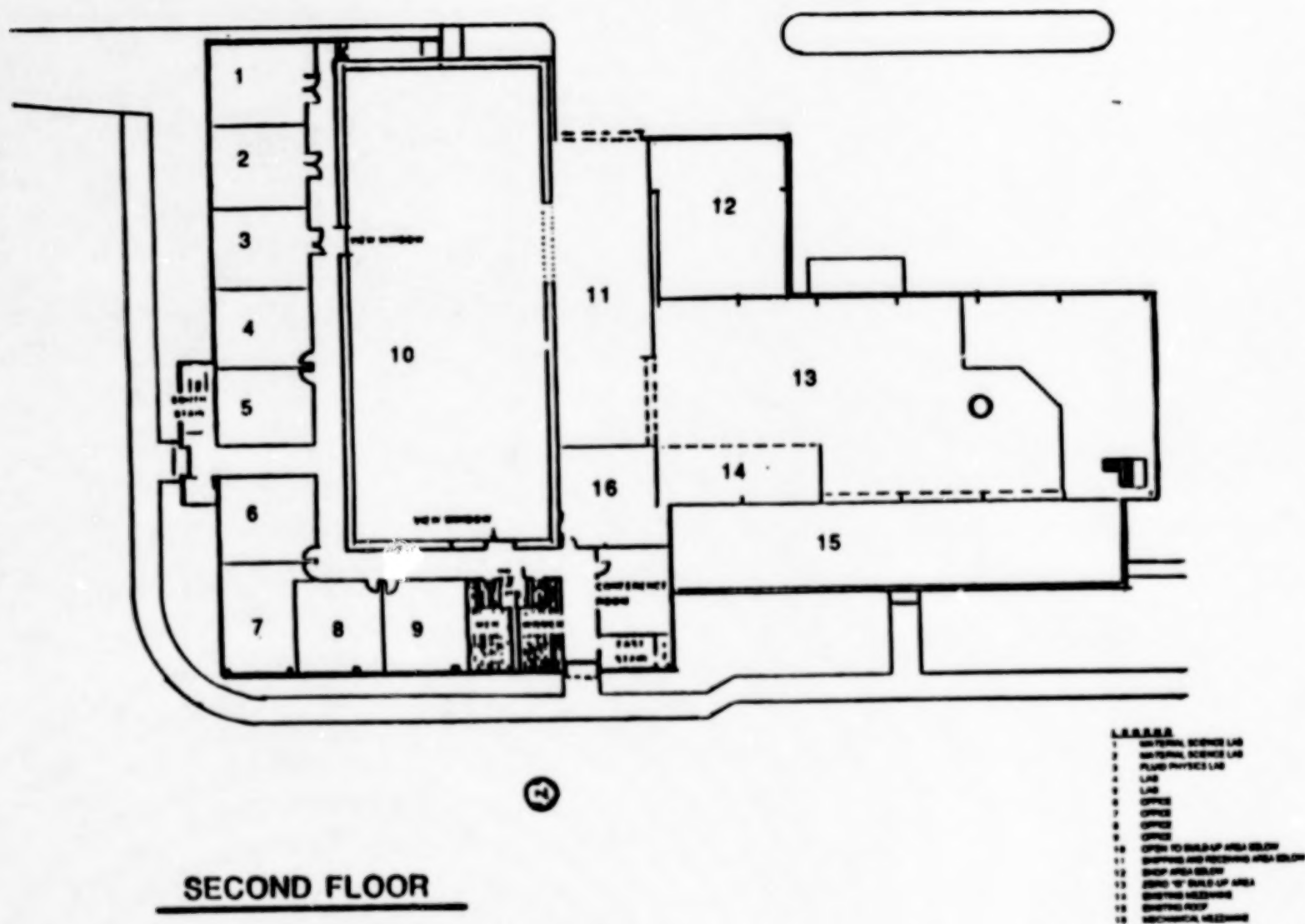
**LEWIS RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF SPACE EXPERIMENTS LABORATORY**



**LEWIS RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF SPACE EXPERIMENTS LABORATORY**

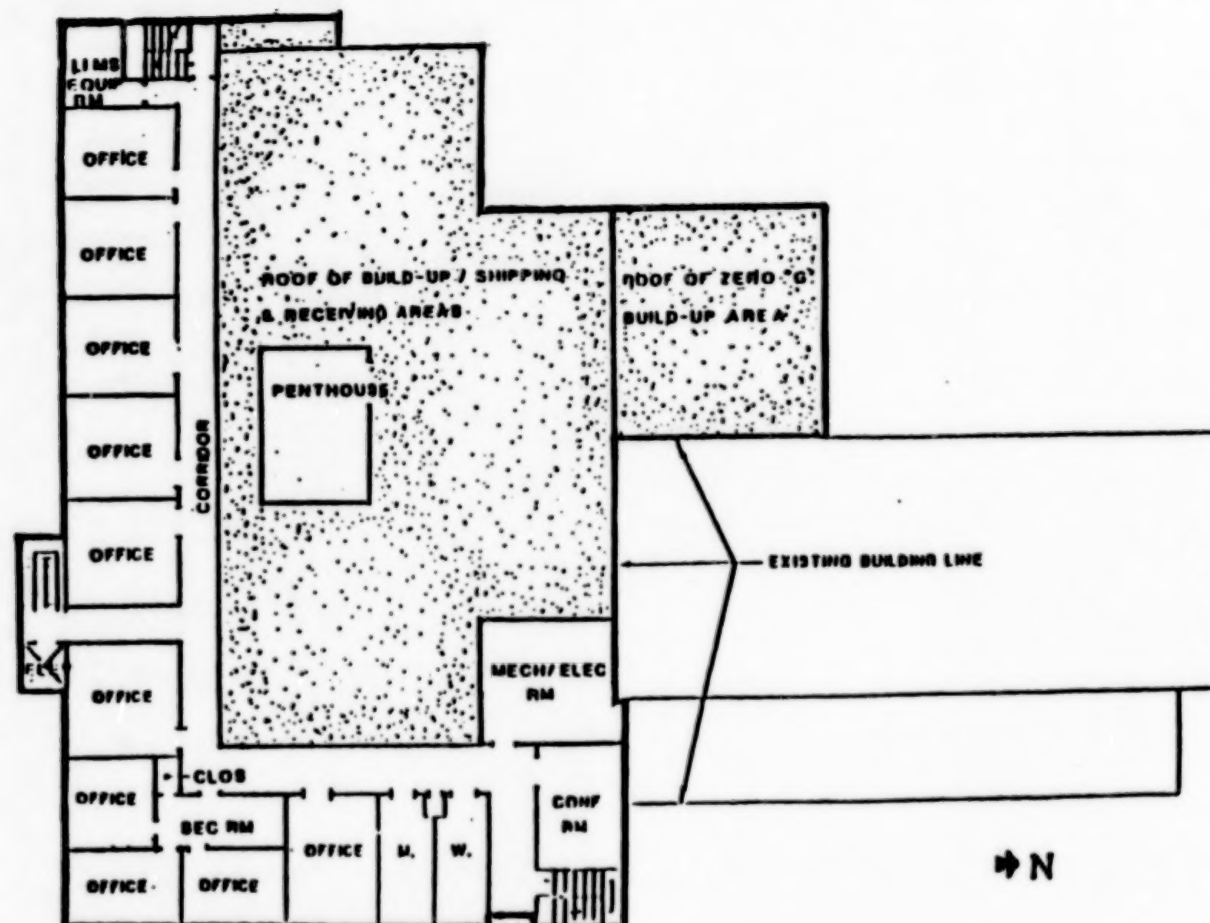


**LEWIS RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF SPACE EXPERIMENTS LABORATORY**



CF 11-6

**LEWIS RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATES
CONSTRUCTION OF SPACE EXPERIMENTS LABORATORY**



THIRD FLOOR

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Refurbishment of Electric Power Laboratory

INSTALLATION: Lewis Research Center

FY 1991 CoF Estimate: \$8,900,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$458,000	---	\$ 458,000
Capitalized Investment.....	---	\$6,602,000	6,602,000
Total.....	<u>\$458,000</u>	<u>\$6,602,000</u>	<u>\$6,660,000</u>

SUMMARY PURPOSE AND SCOPE:

This project will provide the space simulation required for a broad range of research, technology and development programs for power sources, power conversion, thermal management, environmental interaction and electric propulsion. Growth in the number of programs requires assured access to large, low cost, vacuum test chambers. The project will restore an enhanced Tank #6 (25-foot diameter) to service. Cold walls will be installed in Tank #5 (15-foot diameter) and Tank #6 to provide essential thermal vacuum test capabilities. Large space system tests will be possible in Tank #6 by providing full access into the chamber. Increased reliability and pumping speed will be achieved through selected replacement of original mechanical and oil diffusion vacuum pumps.

CF 11-8

PROJECT JUSTIFICATION:

Availability of the two fully functional large vacuum chambers in the Electric Power Laboratory (EPL) is critical to successful conduct of the ongoing space research and technology and development programs sponsored by NASA and cooperative programs with industry and academia. Major efforts in Advanced nuclear space power systems (SP-100), Advanced Solar Dynamics, Thermal Management and Space Station power require large volume chambers with thermal vacuum environments. Other programs including environmental interactions, tether, and electric propulsion basic research and technology (R&T) and development (for Space Station Freedom) additionally require the extremely high pumping speeds offered by these systems. The cost effectiveness and assured access provided by on-site facilities is especially critical for the base R&T programs with their inherent uncertainty and extended test requirements.

At present, the larger Tank #6 (25-foot diameter) is not operational due to internal leaks and mercury contamination from previous ion propulsion system tests. Tank #5 (15-foot diameter) is completely subscribed with present programs which do not include testing of Advanced nuclear space power systems (SP-100), advanced solar dynamic, thermal management systems, or Space Station Freedom power programs. Additionally, neither facility has cold walls and failures are beginning to occur in the 30-year-old vacuum pumping systems, and in facility instrumentation and controls.

IMPACT OF DELAY:

Failure to provide two operational, productive and more cost effective facilities will result in displacement/curtailment of several NASA Base R&T efforts and other specific programs. Serious delays in component development will occur.

PROJECT DESCRIPTION:

This project will provide for repairs and modifications to the two large space environment chambers, installation of a controlled environment assembly area, and modifications to the Facility Central Cryogenic Systems. Specifically, Tank #6 will be restored to an operating condition by removing mercury contamination, and by replacing diffusion pump cold traps, mechanical vacuum pumps, piping and valves. In addition, new cryopanel will be installed in Tank #5 and Tank #6, and both tanks will be structurally modified to accommodate the new cryopanel and other hardware. The Tank #5 mechanical vacuum system will also be replaced, and a new helium compressor will be installed for the existing helium cold wall system. In support of both tanks, the facility controls will be upgraded, the existing liquid nitrogen (LN₂) and freon systems will be modified, and a closed loop water cooling system for vacuum equipment will be installed.

PROJECT COST ESTIMATE: Based on Final Design.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$8,900,000</u>
<u>Tank #6</u>				
Decontaminate Vacuum Tank.....	LS	---	---	\$2,300,000
Replace Vacuum Pumps and Piping.....	LS	---	---	1,200,000
Install LN ₂ Baffle System.....	LS	---	---	1,425,000
Install Clean Room Assembly Area.....	LS	---	---	425,000
Modify Control System.....	LS	---	---	400,000
Vacuum Tank Modifications.....	LS	---	---	420,000
<u>Tank #5</u>				
Replace Vacuum Pumps and Piping.....	LS	---	---	180,000
Install LN ₂ Condenser.....	LS	---	---	1,060,000
Install Helium Compressor.....	LS	---	---	110,000
Vacuum Tank Modifications.....	LS	---	---	250,000
<u>Cryogenic System</u>				
Extend LN ₂ Distribution System.....	LS	---	---	340,000
Vacuum Equipment Cooling System.....	LS	---	---	270,000
Modify Freon System Controls.....	LS	---	---	<u>520,000</u>
Total.....				<u>\$8,900,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan

Figure 2 - First Floor Plan

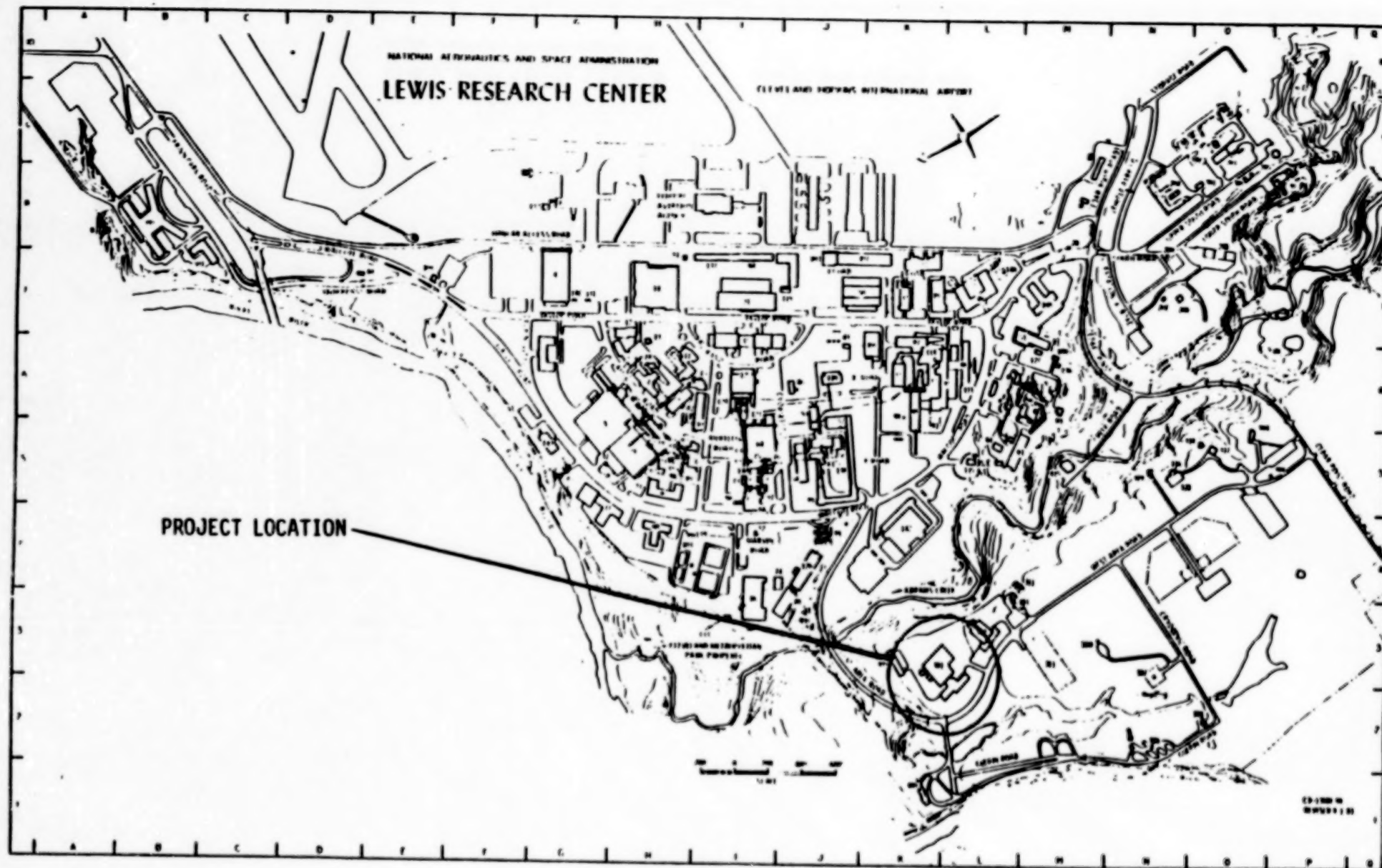
Figure 3 - Ground Floor Plan

OTHER EQUIPMENT SUMMARY/FUTURE ESTIMATED CoF FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No other equipment is required to complete this project. No additional CoF funding is identified at this time.

CF 11-10

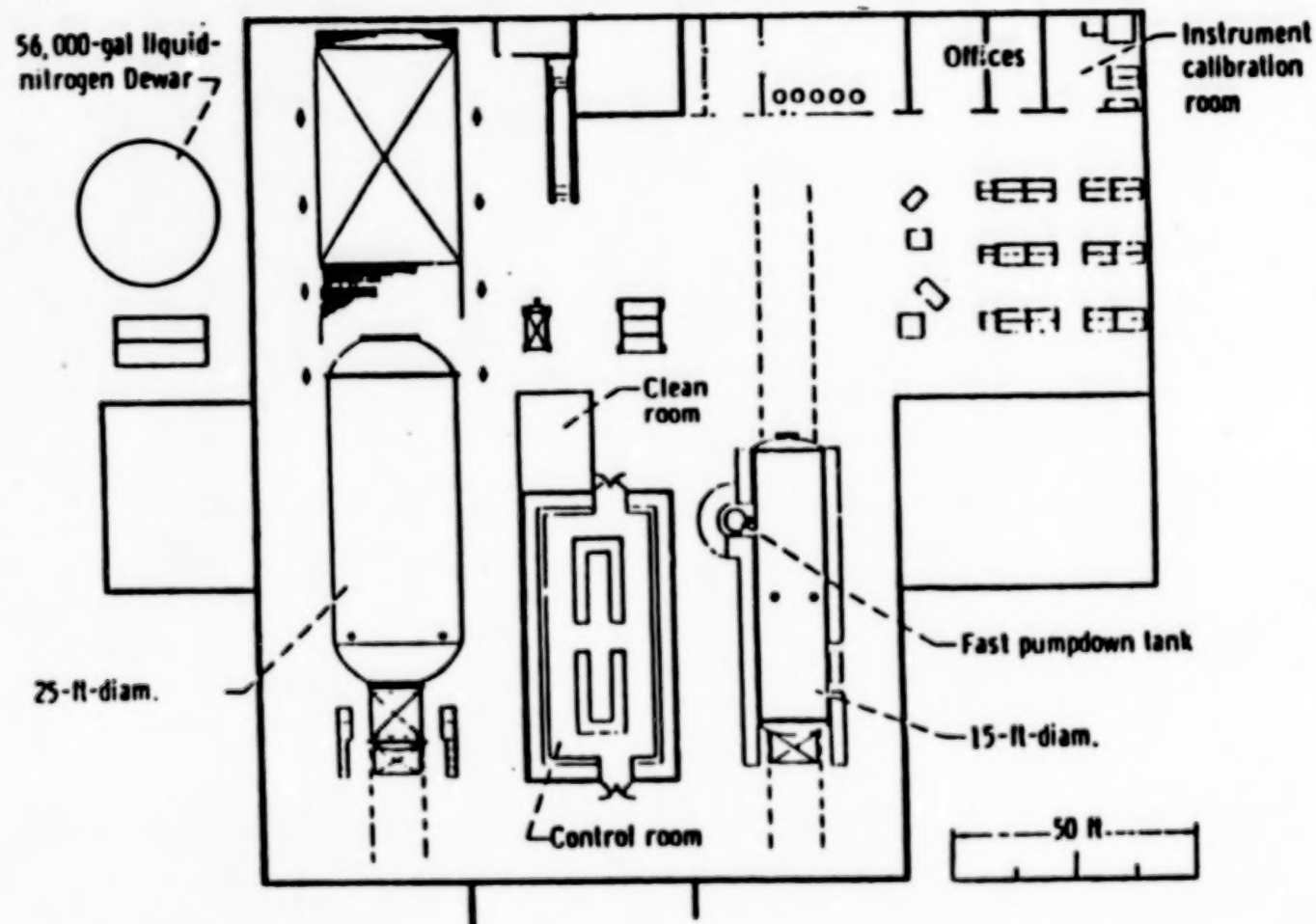
**LEWIS RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATES
REFURBISHMENT OF ELECTRIC POWER LABORATORY**



LOCATION PLAN

CF 11-11

**LEWIS RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATES
REFURBISHMENT OF ELECTRIC POWER LABORATORY**

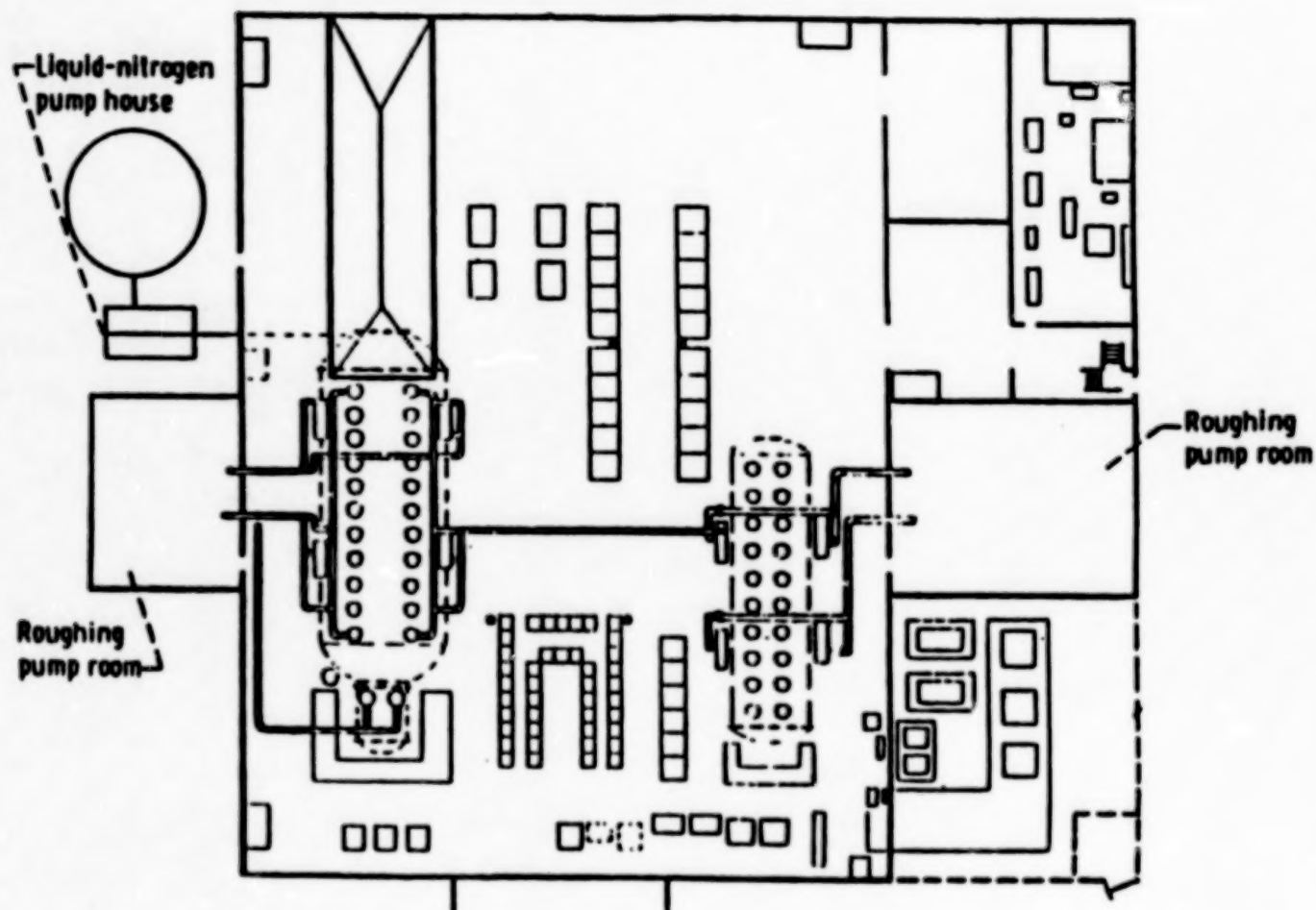


FIRST FLOOR PLAN

FIGURE 2

CF 11-12

LEWIS RESEARCH CENTER
FISCAL YEAR 1991 ESTIMATES
REFURBISHMENT OF ELECTRIC POWER LABORATORY



GROUND FLOOR PLAN

FIGURE 3

CF 11-13

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

SUMMARY

VARIOUS LOCATIONS

<u>Office of Space Operations:</u>	<u>Amount</u>	<u>Page</u>
	(Dollars)	No.
Construction of 34-Meter Multifrequency Antenna, Goldstone, CA.....	13,200,000	CF 12-1
Rehabilitation of 70-Meter Antenna Drive Gear Boxes in Australia, Spain, and Goldstone, CA.....	4,400,000	CF 12-7
Total.....	13,200,000	
	=====	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Construction of 34-Meter Multifrequency Antenna, Goldstone, California

INSTALLATION: Jet Propulsion Laboratory

FY 1991 CoF Estimate: \$13,200,000

LOCATION OF PROJECT: Goldstone, California

COGNIZANT HEADQUARTERS OFFICE: Office of Space Operations

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project.

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF funding.....	\$210,000	---	\$210,000
Capitalized investment.....	---	---	---
Total.....	<u>\$210,000</u>	<u>---</u>	<u>\$210,000</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of a 34-meter high efficiency beam waveguide type multifrequency antenna to replace an obsolete antenna at the Goldstone Deep Space Communications Complex. The replacement antenna will provide performance increases for mission support at the current operating frequencies, and will readily accommodate the higher frequencies required for future deep space missions. Also included is the rehabilitation and modification of Operations Building A-1 at the same site.

PROJECT JUSTIFICATION:

This project is the first of a sequential program for replacement of the three obsolete 34-meter standard (STD) antennas at the Deep Space Network (DSN) complexes in Goldstone, California; Canberra, Australia; and Madrid, Spain. The 34-meter STD antenna at the Goldstone Echo site will be 31 years old when it is replaced by this new multifrequency antenna. The STD antennas have developed severe structural and mechanical problems that could cause major failures resulting in antenna downtimes of several months to over a year. Further, support requirements of most missions in the latter 1990s exceed the capability of the existing STD antennas. Replacement of the STD antennas is vital to ensure DSN reliability in meeting mission support requirements. The new 34-meter multifrequency replacement antennas will provide the additional support capability needed and will eliminate the risks of mission support loss from STD antenna structural and mechanical failures. The improved performance has strong potential for helping provide the required Galileo spacecraft support during the encounter with Io, a moon of the planet Jupiter. The STD antennas must be removed from service to allow microwave systems and related electronics to be transferred to the new 34-meter replacement antennas. Sequential replacement of the three STD antennas is necessary so that mission support from only one DSN complex at a time is impacted.

IMPACT OF DELAY

This project for Goldstone must begin in FY 1991 so that the planned FY 1992 and FY 1993 CoF projects for a replacement antenna at both Australia and Spain can be completed by early 1995 to provide the full DSN operational configuration needed for the period of intense mission support that begins then. This period includes the critical 1995 observatory and encounter phases of the Galileo mission to Jupiter, later phases of the Galileo mission, and other missions including Mars Observer, Cassini, Comet Rendezvous Asteroid Flyby, Ulysses, International Solar Terrestrial Physics, and Search for Extraterrestrial Intelligence. The DSN also will continue to support the distant Voyager and Pioneer spacecraft in their extended mission phases. Delay of this project would adversely impact the full availability of reliable DSN support that is needed to meet the intense mission support requirements that begin in 1995 and include the Galileo Jupiter encounter.

PROJECT DESCRIPTION:

This project includes the design, fabrication and installation of the antenna structure, panels, gearboxes, bearings, electric drives, encoders, beam waveguide mirrors, subreflector, and subreflector positioner. It also includes the construction of the foundation and supporting facilities. The facilities and site development include grading, road paving, drainage, electrical power distribution, water, safety systems, cable trays, trenches, heating, ventilation, and air conditioning. Demolition of the 34-meter STD antenna at DSS-12 (ECHO) is also included. The project also includes the rehabilitation and modification of the Operations Building (A-1) at the Apollo site to provide housing for the new antenna operations and control functions, and to bring the building into compliance with the Uniform Building Code (UBC) Seismic Zone IV requirements.

PROJECT COST ESTIMATE:

Based on a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>				<u>\$13,200,000</u>
Demolition.....	LS	--	--	\$220,000
Site Work.....	LS	--	--	490,000
Antenna Construction.....	LS	--	--	11,440,000
Modifications to Building A-1.....	LS	--	--	1,050,000
Total.....				<u>\$13,200,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan Figure 2 - Site Plan Figure 3 - Rear Elevation

OTHER EQUIPMENT SUMMARY: None.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

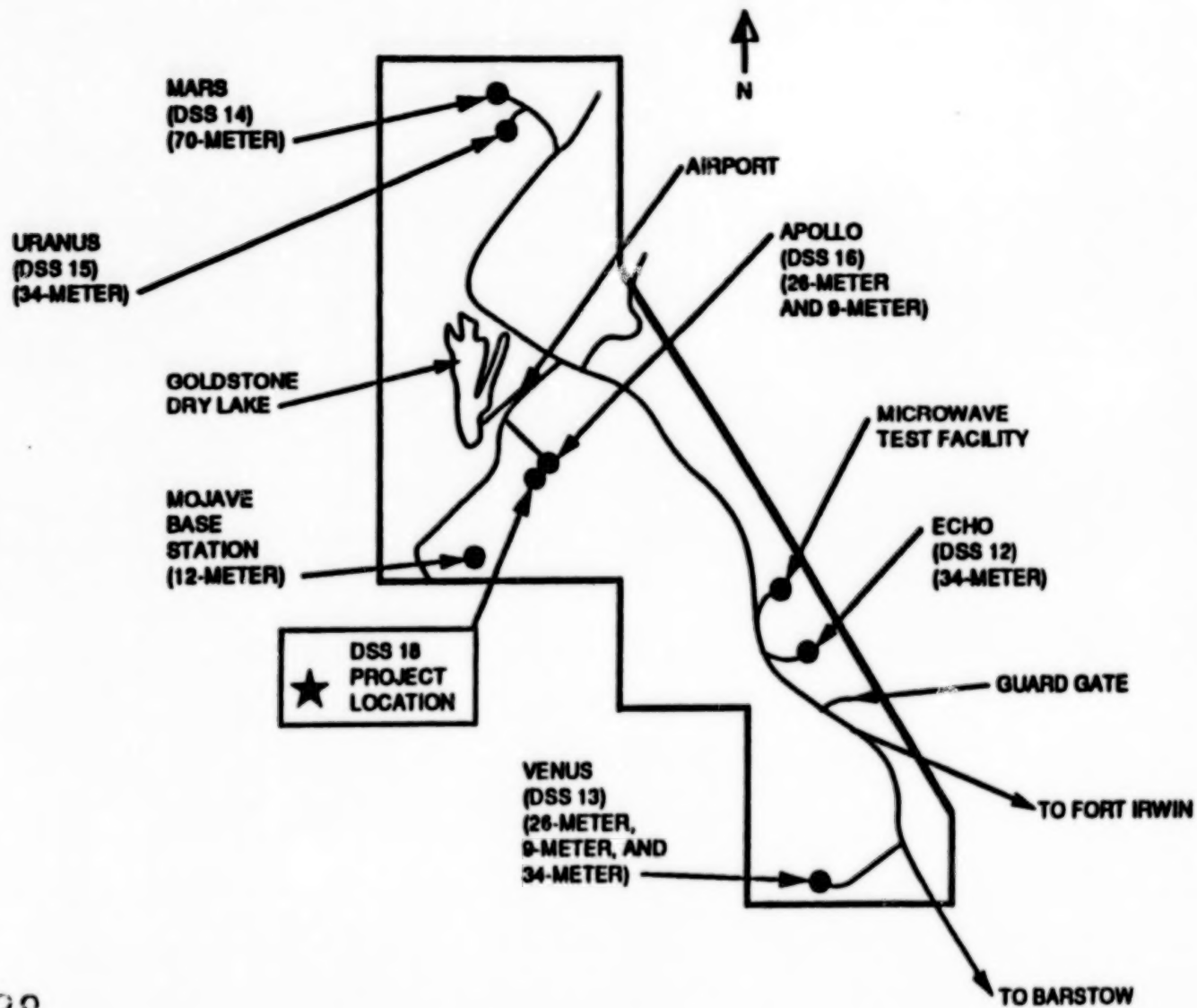
This project will result in a stand-alone beam-waveguide antenna and supporting facility at Goldstone, California. Future 34-meter STD antenna replacements are planned at the DSN locations in Australia and Spain in FY 1992 and FY 1993.

VARIOUS LOCATIONS

FISCAL YEAR 1991 ESTIMATES

CONSTRUCTION OF 34-METER MULTIFREQUENCY ANTENNA, GOLDSTONE, CALIFORNIA

LOCATION PLAN

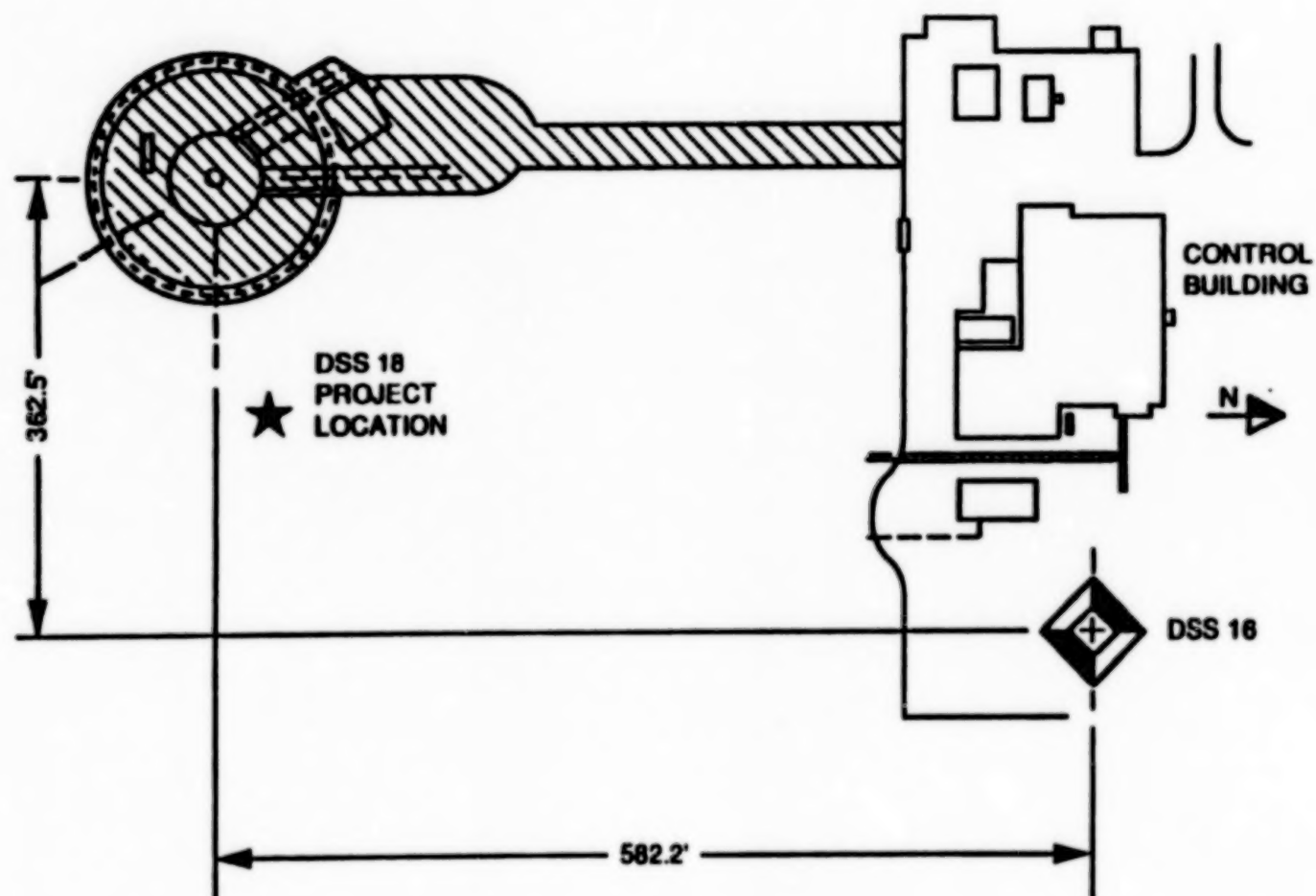


VARIOUS LOCATIONS

FISCAL YEAR 1991 ESTIMATES

CONSTRUCTION OF 34-METER MULTIFREQUENCY ANTENNA, GOLDSTONE, CALIFORNIA

SITE PLAN

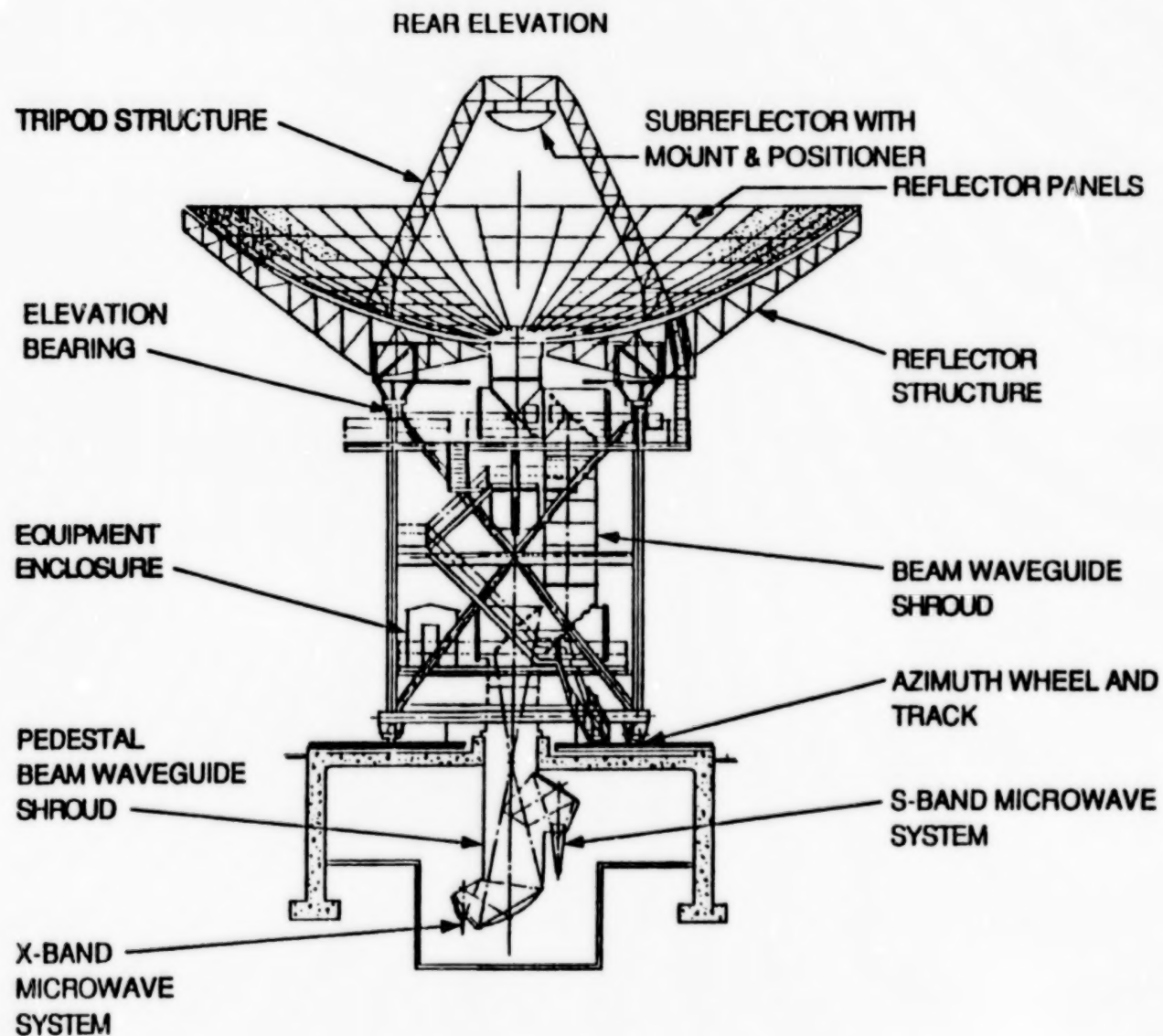


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VARIOUS LOCATIONS

FISCAL YEAR 1991 ESTIMATES

CONSTRUCTION OF 34-METER MULTIFREQUENCY ANTENNA, GOLDSTONE, CALIFORNIA



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Rehabilitation of 70-Meter Antenna Drive Gearboxes

INSTALLATION: Jet Propulsion Laboratory

FY 1991 CoF Estimate: \$4,400,000

LOCATION OF PROJECT: Deep Space Network complexes at Canberra, Australia; Madrid, Spain; and Goldstone, California

COGNIZANT HEADQUARTERS OFFICE: Office of Space Operations

FY 1990 AND PRIOR YEARS' FUNDING: The following prior years' funding is related to this project:

	<u>Planning and Design</u>	<u>Construction</u>	<u>Total</u>
Specific CoF Funding.....	\$299,000	---	\$ 299,000
Capitalized Investment.....	---	<u>\$44,720,000</u>	<u>44,720,000</u>
Total.....	<u>\$299,000</u>	<u>\$44,720,000</u>	<u>\$45,019,000</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the fabrication, installation, alignment and testing of new main drive gears in the four elevation and the four azimuth drive gearboxes for each of the three 70-meter Deep Space Network (DSN) antennas. The existing gears have deteriorated significantly and have jeopardized the reliable operations of the antennas.

PROJECT JUSTIFICATION:

Inspection of the 20-year-old gearboxes has revealed serious gear deterioration. These gears had an original design life of ten years and have exceeded their useful life. If the gearbox fails, it will result in antenna shutdown for an extended period of time, perhaps months, hence jeopardizing spacecraft missions. Interim repairs, together with reversing of the gears to utilize non-damaged wear surfaces, have temporarily extended the life of the gearboxes. However, the gears continue to deteriorate rapidly. The improved materials and techniques to be employed in this rehabilitation project should extend the antenna life by 20 years.

IMPACT OF DELAY:

Delay of this project will increase the risk of an antenna failure that would result in lost mission support. Failure during a critical spacecraft support period will adversely impact mission success.

PROJECT DESCRIPTION:

This project provides for the fabrication and purchase of gearbox components at each of the three 70-meter antennas. Included are four complete new elevation gearboxes and 24 sets of new internal components for the existing elevation and azimuth gearboxes. The new gearbox components will be designed to meet the requirement for a 70-meter antenna and have a minimum life of 20 years. Installation will be accomplished by the existing on-site operations and maintenance contractor to minimize operational downtime. One complete spare set of 4 refurbished elevation gearboxes, including 4 spare sets of azimuth unique gears, will exist upon completion of this project.

PROJECT COST ESTIMATE: Based on a Preliminary Engineering Report.

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Cost</u>
<u>Construction</u>	---	---	---	<u>\$4,400,000</u>
Elevation Gearboxes, Complete w/Internals.....	EA	4	240,000	960,000
Internal Components.....	SETS	24	143,333	3,440,000
Total.....				<u>\$4,400,000</u>

LIST OF RELATED GRAPHICS:

Figure 1 - Azimuth Gear Reducer Locations
Figure 3 - Elevation Gear Reducer Side View

Figure 2 - Elevation Gear Reducer Locations

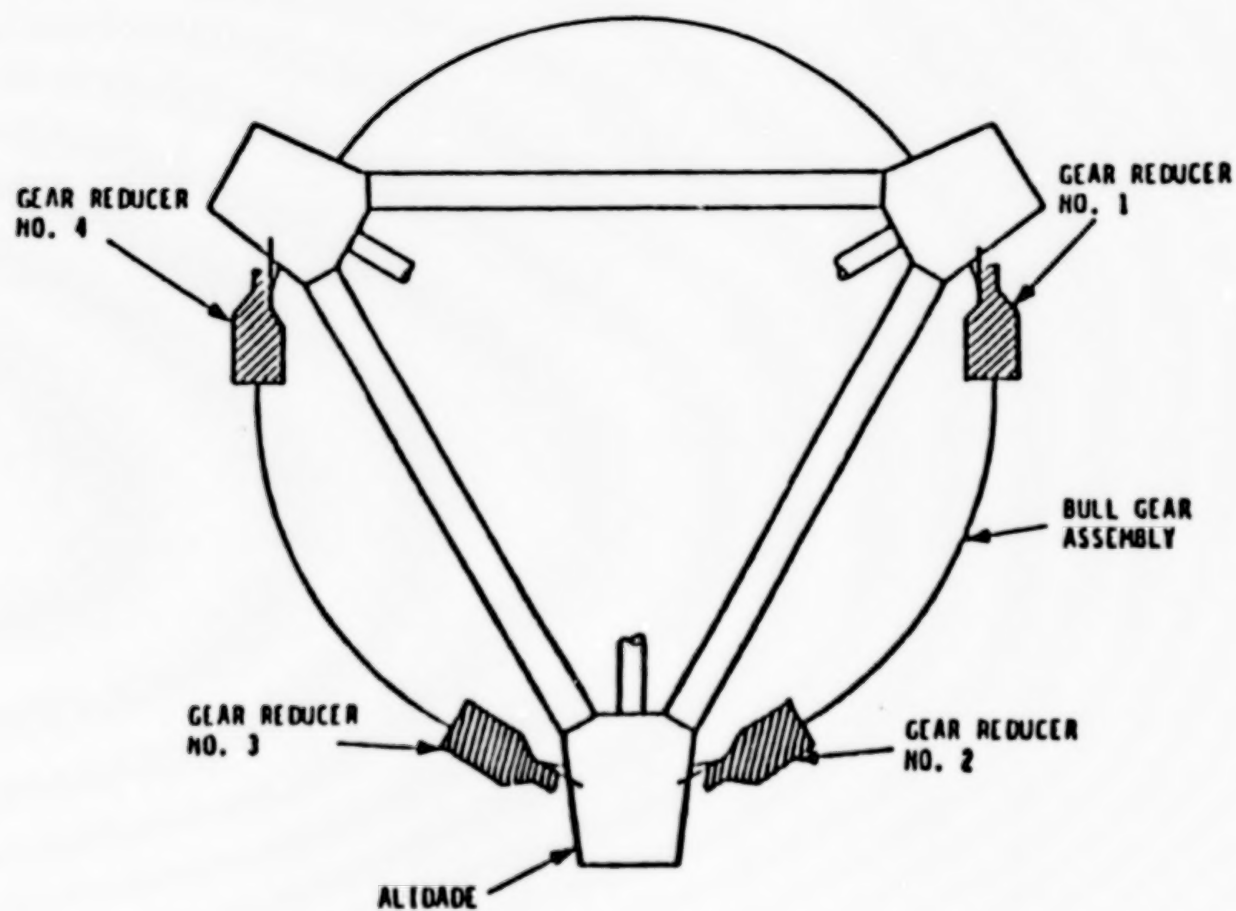
OTHER EQUIPMENT SUMMARY:

No other equipment is required to complete this project.

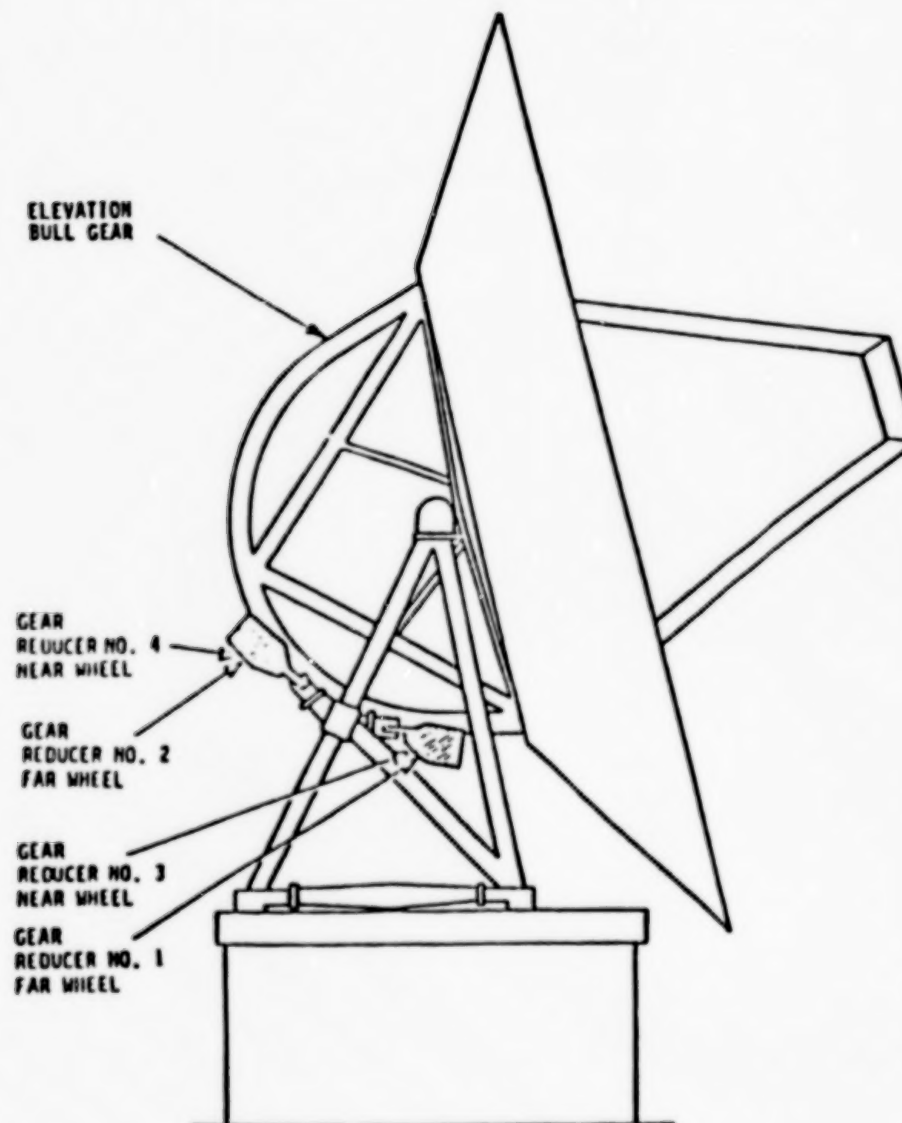
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project.

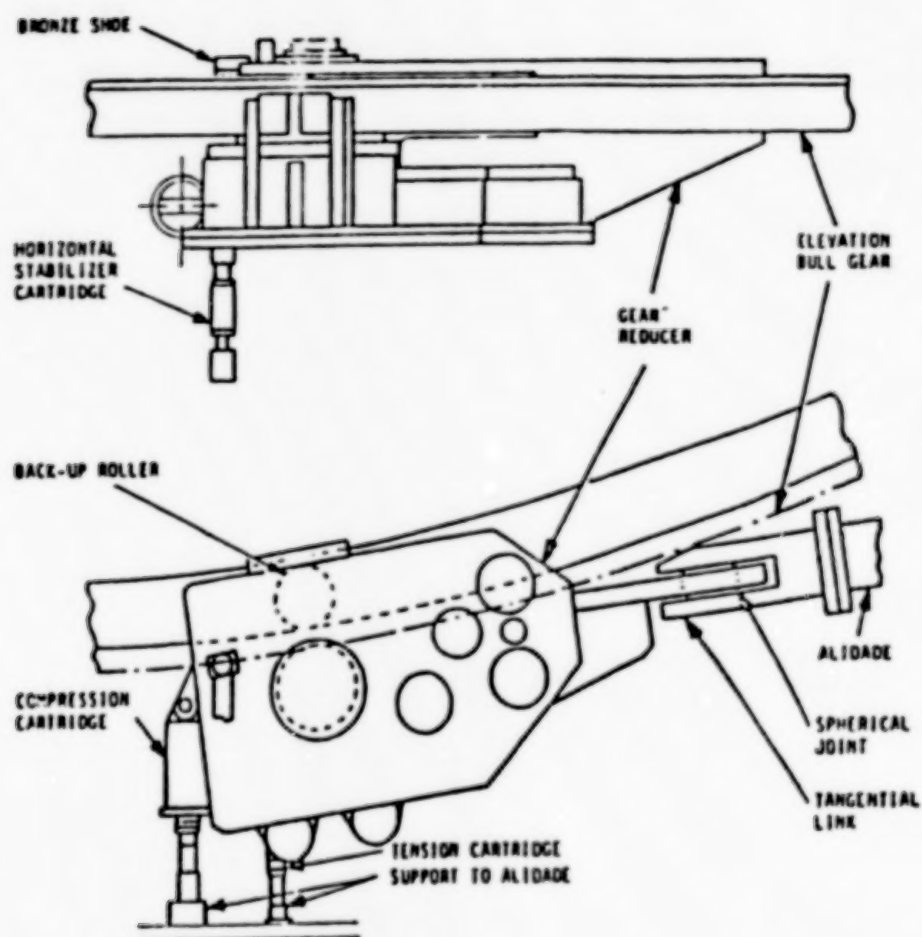
VARIOUS LOCATIONS
FISCAL YEAR 1991 ESTIMATES
REHABILITATION OF 70-METER ANTENNA DRIVE GEARBOXES
AZIMUTH GEAR REDUCER LOCATIONS



VARIOUS LOCATIONS
FISCAL YEAR 1991 ESTIMATES
REHABILITATION OF 70-METER ANTENNA DRIVE GEARBOXES
ELEVATION GEAR REDUCER LOCATIONS



VARIOUS LOCATIONS
FISCAL YEAR 1991 ESTIMATES
REHABILITATION OF 70-METER ANTENNA DRIVE GEARBOXES
ELEVATION GEAR REDUCER SIDE VIEW



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

SUMMARY

REPAIR

Summary of Project Amounts by Location:

	<u>Amount</u>	<u>Page No.</u>
Ames Research Center.....	\$ 3,440,000	CF 13-3
Dryden Flight Research Facility.....	540,000	CF 13-4
Goddard Space Flight Center.....	2,970,000	CF 13-5
Jet Propulsion Laboratory.....	1,860,000	CF 13-6
Johnson Space Center.....	2,500,000	CF 13-8
Kennedy Space Center.....	3,525,000	CF 13-9
Langley Research Center.....	3,410,000	CF 13-11
Lewis Research Center.....	3,590,000	CF 13-13
Marshall Space Flight Center.....	1,450,000	CF 13-14
Michoud Assembly Facility.....	2,340,000	CF 13-15
Stennis Space Center.....	1,300,000	CF 13-16
Wallops Flight Facility.....	1,875,000	CF 13-17
Various Locations.....	500,000	CF 13-18
Miscellaneous Projects Not in Excess of \$150,000 Each.....	<u>700,000</u>	CF 13-18
Total.....	<u><u>\$30,000,000</u></u>	

247

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Repair of Facilities, Not in Excess Of \$750,000 Per Project

INSTALLATION: Various Locations

FY 1991 CoF ESTIMATE: \$30,000,000

FY 1989: \$22,900,000

FY 1990: \$27,200,000

COGNIZANT INSTALLATIONS/LOCATIONS OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management

SUMMARY PURPOSE AND SCOPE:

These resources will provide for large repairs to facilities at NASA field installations and Government-owned industrial plants supporting NASA activities. Included in the request are those facility repair needs for FY 1991 that can be predicted at the time of the submission of these estimates and are not to exceed \$750,000 per project. The thrust of this program is to restore facilities and components thereof, including collateral equipment, to a condition substantially equivalent to their originally intended and designed capability. The request includes the substantially equivalent replacement of utility systems and collateral equipment necessitated by incipient or actual breakdown. This work also includes major preventive measures which are normally accomplished on a cyclic schedule of greater than one year.

PROJECT JUSTIFICATION:

A major portion of the agency's facilities exceeds 25 years in age, and increases in repair requirements are to be expected. Maintenance and repair costs for mechanical and electrical systems in a typical building are almost three times higher during the 16- to 30-year period of a building's life than they are during the

initial 15 years. Many electrical and mechanical components reach the end of their serviceable or economic life at about the 15 to 20 year point and should be replaced in the interest of long-term economy. Continued piecemeal repair of these components is usually more costly in the long run than replacement at the end of the economic life of the original components. Approximately 75 percent of NASA's physical plant is in the 16- to 30-year old category.

A major thrust of this repair program is to help preserve the capabilities of the agency's \$4.1 billion physical plant. An analysis of each project clearly indicates that this work must be addressed and progressively accomplished. Otherwise, risks are increased and future repair costs will be significantly greater. More importantly, there will be increased breakdowns, interruption of critical operations and costly unscheduled repairs incurred.

This program includes only facility repair work having an estimated cost not in excess of \$750,000 per project. The work is of such a nature and magnitude that it cannot be accomplished by routine day-to-day facility maintenance and repair activities. Repair projects estimated to cost more than \$750,000, are included as separate discrete projects in the budget request.

PROJECT DESCRIPTION:

Proposed repair projects for FY 1991 totaling \$30,000,000 are described under "PROJECT COST ESTIMATE." Projects estimated to cost not in excess of \$150,000 have not been individually described or identified by Center. The total request for this category is \$700,000. This repair program has been distilled from requests of approximately \$49,000,000, and thus represents a modest request in relation to the continuing backlog of this type of work. Based on relative urgency and expected return on investment, the projects which comprise this request are of the highest priority. Deferral of this mission-essential work would adversely affect the availability of critical facilities and program schedules.

During the course of the year, it is recognized that some rearrangement of priority may be necessary. This may force a change in some of the items to be accomplished. Any such change, however, will be accomplished within total available repair resources. The following broad categories of work are described further in the "PROJECT COST ESTIMATE":

a. Utility Systems.....	6,330,000
b. General Purpose Buildings.....	4,970,000
c. Technical Buildings/Structures.....	9,345,000
d. Pavements and Drainage.....	5,385,000
e. Building Exteriors and Roofs.....	3,970,000

PROJECT COST ESTIMATE:

A. <u>Ames Research Center (ARC)</u>	<u>\$3,440,000</u>
1. Repair of Air Conditioning (N-203).....	740,000

This project will replace a cooling tower, four air-conditioning units, the steam heating system with a hot water system, and the chilled water plant. It will also replace the flaking interior lined ducts throughout the facility. Asbestos will be removed from the chilled water lines and pipes installed in the 1940's will be replaced. All this equipment is at least 25 years old and showing marked deterioration. All the equipment is past its operational life and repair costs have been increasing.

2. Repair of Roofs (N-207, N-213, & N-237).....	420,000
---	---------

This project will install new roofs on three buildings, N-207, N-213, and N-237, comprising approximately 67,000 square feet. These roofs are from 16 to 21 years old. Problems include large number of leaking roofs, damage related to roof-mounted equipment, and eliminating potential damages to equipment housed in these buildings.

3. Repair of Pressure Systems, Various Locations.....	740,000
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This project provides for the repair and recertification of various high pressure system components found to be defective by the Pressure Vessel Recertification Program. It will repair control and isolation valves serving the 3.5-Foot Hypersonic Wind Tunnel; repair the cathodic protection system on all underground high pressure air piping; and repair all above ground high pressure air system structural reinforcements. It is necessary that these items be repaired to minimize risk of catastrophic failure of the systems and assure uninterrupted operation of the associated research facilities.

4. Repair of Arc Jet Water System (N234A)..... 530,000

This project will provide for replacement of water softeners, controls, and other components of water systems in the Arc Jet Complex. The boiler is 27 years old and on-demand operation and thermal cycling have resulted in severe wear on all systems. Boiler economizer tubes and feedwater water softeners have eroded badly, requiring constant maintenance. Eventual failure of the economizer tubes and water softeners is inevitable because both are in advanced states of deterioration. Water softener failure could result in boiler shutdown for extended periods. The boiler and arc jet cooling-water system are crucial to the operation of the arc jets. Excessive downtimes for unscheduled repairs will severely impact the research on thermal protection materials for NASA and DOD missions in this arc jet complex.

5. Repair of Natural Gas Distribution System..... 440,000

This project will repair natural gas supply lines, valves, the propane system, and monitor alarm and control circuits. The 25-year-old supply lines have chronic leaks which are hazardous and require frequent repair. The monitoring alarm and control circuits, which allow remote monitoring of gas usage and provide alarms if the main pressure drops, are inoperative. Repair records show continually growing efforts in patching and other piecemeal repair work.

6. Repair Oil Circuit Breakers, 14-Ft. Pressure Wind Tunnel (N218)..... 570,000

This project will replace the main 6,900 volt oil circuit breakers with new breakers. The existing enclosures will be reused and the main 480 volt switchgear will be replaced. The existing 6,900 volt circuit breakers are over 40 years old, and are obsolete and extremely difficult to maintain to today's standards. Yearly servicing requires excessive periods of time and costs. New technology breakers are more reliable and versatile (with adjustable set points), and require only a fraction of the maintenance needed by the deteriorated oil circuit breakers.

- B. Dryden Flight Research Facility (DFRF)..... \$540,000

1. Repair of Natural Gas Distribution System..... 540,000

This project will replace the existing 10,000 foot cast iron distribution system. All lines will be replaced up to and including the meter at each building. A seismic shut-off valve will also be installed. There have been several major leaks in the last three years. Excavation of the line at the leaking areas

shows that the line is not wrapped in all locations and that soil conditions cause rapid penetration of the unwrapped lines. Replacement is the only viable solution.

C. Goddard Space Flight Center (GSFC)..... \$2,970,000

1. Repair Air Handling Units, Various Buildings..... 700,000

This project provides for the repair of fifteen air-handling systems in the Space Projects Building (1), the Instrument Construction and Development Laboratory (Bldg. 5), and the Space Sciences Laboratory (Bldg. 6). Work will include replacement of existing air-handling units and changes to the distribution configuration. The air-conditioning systems in these buildings are beyond their normal life expectancy and are not sized to properly serve the present load. The systems must be replaced to meet current building requirements and reduce maintenance times and costs.

2. Repair Roofs, Various Buildings..... 600,000

This project proposes the removal and replacement of approximately 62,500 square feet of existing roofing on the Instrument Construction and Development Laboratory (Bldg. 5), Environmental Testing Laboratory, (Bldg. 10), and Meteorological Systems Installation Laboratory, (Bldg. 21), including removal and replacement of associated coping, flashing and other roof accessories. Drainage problems will be corrected and rooftop walkways will be provided. The existing roofing on these buildings contain numerous patches and temporary repairs. This necessary rehabilitation will restore the integrity of these roofing systems and minimize potential property loss from water damage due to leaking roofs.

3. Repair of Electrical Systems, Various Buildings..... 650,000

This project provides for the replacement of electrical load centers for Buildings 5, 6, 7, 11, 12 and 17. The work includes replacement of the secondary main circuit breakers, tie breaker and feeder breakers with new equipment including metering, relays and mechanical/electrical interlocks. The existing load centers are reaching the end-of-service life and require replacement to maintain adequate and reliable electrical service.

4. Repair of Interior Systems, Buildings 1 and 2..... 350,000

This project provides for the repair of interiors of Space Projects Building (1), and Research Projects Laboratory (2). Work includes removal and replacement of ceiling systems and repair of existing

walls and partitions. Extension of sprinkler heads, HVAC ducts and grilles will also be required. Asbestos testing and disposal will be required for some flooring. These buildings are approximately 30 years old and no major interior repairs have been performed. This project will restore Buildings 1 and 2 to reasonable and acceptable standards.

5. Repair Gaseous Nitrogen System, Building 7/10..... 420,000

This project provides for the repair of the gaseous nitrogen (GN2) compressor system for the Payload Testing Facility, Building 7; and Environmental Testing Laboratory, Building 10, complex. The work includes replacement of the GN2 compressor skids, refurbishment of the bottle storage banks including two additional bottles for Building 7 and new dome pressure regulators and interconnecting plumbing at both locations. This project provides the replacement and upgrading of a 25-year-old GN2 compressor system which is used daily to produce high pressure GN2 for the 7/10 complex. Nitrogen is used for backfill of vacuum chambers, clean, dry purging of spacecraft components, precision cleaning, make up of thermal system gas and as the drive gas for the Acoustic Test Facility. Wear of components through use and weathering has resulted in gradual deterioration of the system. Increased reliability is required for processing payloads and to meet operational schedules.

6. Repair Paved Surfaces..... 250,000

The project provides for the repairs of Tiros Road, from the Soil Conservation Service Road Gate to Buildings 4 and 24; Minitrack Road, from Road No. 20 to Road No. 2; and Goddard Road, from Tiros Road to Explorer Road. Work will also include repairs of storm drain inlets and relocation of curbs to facilitate easy access for semi-trailer truck traffic. The asphalt paving and associated work are required to eliminate the current excessive maintenance and to restore good operating conditions of the Tiros Road, Minitrack Road, and Goddard Road. These roads were constructed in the 1960's with minimal depth of asphalt and, due to heavy usage, have deteriorated seriously. Numerous potholes, depressions, "bird baths," and alligating have developed, resulting in accelerated deterioration and unsafe conditions.

D. Jet Propulsion Laboratory (JPL)..... \$1,860,000

1. Repair Earthquake Damage, Telecommunications Building (238)..... 720,000

This project provides for structural repair of damage to shear wall diaphragms in the eight-story Building 238. All earthquake caused cracks in the structural walls between the second and sixth floors will have the existing plaster coating removed and the structural wall repaired by epoxy grouting. Additionally,

the second and third floor walls will be strengthened by adding gunite to thicken the existing core shear walls and by constructing approximately 335 lineal feet of new shear walls at selected locations. The floor beams at the existing central core structural walls are encased in concrete and will be reinforced to accept the thickened walls. The earthquakes of 1987 opened the cracks in Building 238 and caused shear wall damage, particularly to the second through fifth floor central core walls with some noticeable damage to adjacent floor areas. Although this building withstood the 1987 earthquake, it is clear obvious that significant structural damage occurred. Structural repairs are required to bring the building into compliance with JPL's life safety criteria.

2. Repair Restrooms, Control Systems Laboratory (198)..... 240,000

This project provides for the repair of the restrooms in Building 198. The existing toilet partitions will be removed and replaced with new partitions, all plumbing fixtures will be replaced with new fixtures, and new accessories will be provided. The restroom ventilation system will be modified and upgraded as required, and the gypsum board walls and ceilings will be repaired and painted. Regular maintenance can no longer keep the plumbing system functioning in an acceptable manner. In addition, the ventilation systems for these rooms is inadequate and the facilities do not meet current handicapped requirements. The plumbing fixtures and ventilation system have exceeded their normal life expectancy and must be replaced.

3. Repair Paving, Explorer Road..... 500,000

This project provides for the repair of the asphaltic concrete paving on 2,100 linear feet of Explorer Road and parking areas contiguous to the roadway surface between Ranger Road and Mariner Road. Approximately 85,000 square feet of paved area is included in the proposed project. Reconstruction of the paving involves the removal of the existing paving, finish grading and placement of three inches of new paving over a 6-inch base course. This project includes resetting existing utility manholes and catch basins. Concrete swales, walks, curbs and gutters will be constructed where existing ones are severely deteriorated and where none exist. The existing roadway is 20 years old and has deteriorated into a hazardous condition. Pavement is irregular, cracked and alligatored and has become a drainage problem due to repeated repairs. The condition of the road has become unsafe for vehicular and pedestrian traffic.

4. Repair Roads, Edwards Test Station..... 400,000

The project provides for the repair of asphaltic concrete paving on portions of Propulsion Drive, Circle Drive, Liquid Loop Road and access roads to the majority of buildings on site, providing new paving for an extension of Circle Drive and repairing of existing paving at other places. The existing paving has deteriorated to a point where it is no longer maintainable. Large cracks and alligatoring of the pavement allow water to penetrate to the subgrade which eventually damages adjacent paving.

E. Johnson Space Center (JSC)..... \$2,500,000

1. Replace Central Fire Alarm and Security System..... 720,000

This project provides for the replacement of the existing central fire alarm and security systems located in the Fire Station, Building 25, with a single central processing system. Also included is the replacement of approximately 125 existing transponders (no longer manufactured) with transponders which are compatible with the new central system. Additionally, this project includes the replacement of underground fire alarm cables in the 100 area and overhead fire alarm cables in the 200 area. This project is necessary to replace the existing obsolete central fire alarm and security system.

2. Repair Manned Test Support Systems for Chamber A(32)..... 350,000

This project provides for the repair of the manned test support systems which support Chamber A in the Space Environment Simulation Laboratory, Building 32. The work includes the inspection, testing, and recertification of the entire emergency repressurization system for this man-rated vacuum system. High-pressure valves and controls will be replaced as required. This project also will include installation of a new control system and fire detection and suppression systems. NASA has no other large man rated chamber to perform tests which are necessary to verify, certify and qualify large Space Station Freedom extravehicular activity airlock systems.

3. Repair 15kV Power Cable, Utility Tunnel System..... 500,000

This project provides for repair of the Center's electrical power distribution system by replacing feeder cables 1-5, 1-9, and 1-11 in the utility tunnel system. The work includes the replacement of approximately 6,500 linear feet of 15-kV armored 3-conductor aluminum cable serving buildings 24, 30, 44, 45, 47, and 48. The existing aluminum conductor polyethylene insulated cable in the Center's electrical distribution system has been in continuous operation for more than 24 years. Frequent outages and deterioration of the cable mandate replacement to assure reliable electrical power for the Center's critical facilities.

4. Repair Site Roofs, White Sands Test Facility..... 630,000

This project provides for the removal and replacement of built-up roofs on approximately 20 buildings at the White Sands Test Facility. The work includes approximately 200,000 square feet of roof and replacement of flashing as required. These building roofs have exceeded their expected lifetime and require major repair. The repair work required to bring the roofs to an acceptable condition is beyond the scope of normal maintenance.

5. Repair Roofs, Buildings 17 and 45..... 300,000

The project includes replacing approximately 49,860 square feet of roofing and 940 linear feet of flashing on Building 17 and approximately 17,280 square feet of roofing and 530 linear feet of flashing on the library wing of Building 45. The deteriorated conditions of these roof areas exceed the ability of normal maintenance remedy. This project is needed to avoid damage to the building structure, as well as damage to interior ceiling panels, electrical panels, and other sensitive equipment contained in the buildings.

F. Kennedy Space Center (KSC)..... \$3,525,000

1. Replace High Temperature Hot Water Boiler #3 at
Vertical Assembly Building Utility Annex..... 485,000

This project will remove and replace high temperature hot water boiler Number 3, at the Vertical Assembly Building Utility Annex, with a boiler having an output capacity of 20 million BTU/hour. The existing 23-year-old boiler has a limited output of only 10 million BTU/hour and has reached the end of its useful life. It is operating at a low efficiency and has deteriorated to a condition where replacement is necessary. Boilers Number 1 and 2 have already been replaced. Three reliable, high capacity boilers are needed to accommodate the heat requirements for Space Shuttle Orbiter facilities.

2. Replace 450-Ton Chillers, Building M6-399..... 690,000

This project provides for removal and replacement of two 450-ton centrifugal air-conditioning chillers in Building M6-399. Replacement includes new chilled water pumps, controls, electrical modifications, and piping needed for the new chillers. The existing chillers have reached the end of their useful life and continually break down. The cost to keep them operational is excessive and increasing. In addition, the existing chillers use more energy than modern equipment, and substantial operating dollars can be saved over the life of the chillers through this replacement.

3. Repair Launch Complex 39 Pad A Compressed Air System..... 450,000

This project is to replace the air compressors and associated equipment at Launch Complex 39, Pad A, including filters, controls, dryers, reservoirs, and cooling towers. A waste oil collection system will be provided to collect oil condensate emitted from compressors. The air compressors are 20 years old and are used continuously. The compressed air system is needed to operate Firex valves and to provide purge gas and shop air. Frequent failures are resulting in high maintenance and repair costs. Installation of a new compressed air system will provide much needed reliability during launch and will reduce operational costs.

4. Replace Operations and Checkout Building High Bay Roof (M7-0355)..... 380,000

This project is to replace 41,400 square feet of roof of the Operations and Checkout Building. This building houses flight hardware and ground support equipment for payload assembly and checkout. A portion of the roof is leaking badly and needs to be replaced to prevent damage to highly sensitive, expensive equipment. Spot repairs are no longer adequate to stop the leaks.

5. Replace Roof System, KSC Headquarters Building..... 390,000

This project will remove and replace the central section of the built-up roofing system on the KSC Headquarters Building. The existing roof is a five-ply conventional built-up roof that has reached the end of its useful life. Maintenance costs are increasing and damage to interior structure, equipment, and finishes could occur at any time if the roof is not replaced.

6. Replace Air Handlers, Ducts, Piping, Vertical Processing Facility (M71467)..... 730,000

This project is to replace seven roof-mounted air handling units and associated exterior ducts and piping at the Vertical Processing Facility (VPF), Building. The existing units are severely deteriorated due to harsh environmental conditions. The equipment supports payload processing, which must be done under strict environmental controls. Failure of the air handling system will result in unacceptable delays in processing payloads. Replacement of the units now will ensure that mission needs are met, and will also save maintenance, repair, and energy costs.

7. Repair NASA Parkway..... 400,000

This project provides for repair of 2.1 miles of east and west-bound lanes of NASA parkway from Kennedy Parkway east to the end of the four-lane section. The project includes replacement of the existing surface, leveling course, and associated striping and concrete pavement repair. The existing paved surface is exhibiting a "shoving" condition in which the top course slides over the underlying pavement. This allows moisture to enter the pavement and leads to structural failure which cannot be rectified by routine maintenance. This is one of the primary roads at KSC.

G. Langley Research Center (LaRC) \$3,410,000

1. Repairs to High Pressure Systems, Various Facilities, West Area 650,000

This project provides for repairs to the high pressure air, steam and gas systems of various facilities located in the West Area of Langley Research Center. The work to be done under this project includes: The replacement of defective piping, valves and fittings, the repair of defective welds, and the radiographic inspection of the repaired welds. Completion of this project is essential to ensure the safe and efficient operation of these essential research facilities.

2. Repairs to Liquid Rheostat, 14 x 22-foot Subsonic Wind Tunnel (1212C)..... 320,000

This project provides for the replacement of the liquid rheostat which controls the electrical power to the drive system of the 14 x 22-Foot Subsonic Wind Tunnel. The work includes removal of the existing liquid rheostat, modifications to piping and wiring to provide for the installation of the new liquid rheostat and associated mechanical and control components. Failure to replace the liquid rheostat could result in the loss of critical tunnel run time while patchwork repairs are made. If a major failure occurs, the tunnel could be shut down for nine months or longer.

3. Repairs to High Pressure Systems, Various Facilities, East Area..... 500,000

This project provides for repairs to vacuum systems, tunnel shells, and the high pressure air and hydraulic piping systems of various facilities located at the East Area of the Langley Research Center. The work to be done under this project includes: the replacement of defective piping, valves, and fittings; the repair of defective welds; and the radiographic inspection of the repaired welds. Completion of this project is mandatory to ensure the safe and efficient operation of vital research facilities.

4. Repairs to the Aircraft Landing Dynamics Facility (1258/1258A)..... 720,000

This project provides for repairs to the Aircraft Landing Dynamics Facility. The work to be accomplished includes replacing the body of the propulsion control valve; replacing the liquid nitrogen storage vessel; and installing an additional high pressure pump and two gaseous nitrogen storage bottles. The body of the existing propulsion control valve is constructed of nickel plated steel, and the shutter assembly is constructed of stainless steel. The nickel plating inside the valve body has been breached and pitting extends into the parent valve body material. Galvanic corrosion between the exposed valve body steel and the stainless steel components of the shutter assembly is reducing the wall thickness of the valve body. This project will replace the existing valve body with a stainless steel body. The replacement of the propulsion control valve body is necessary to ensure continued operating capability at the designed performance levels. The installation of the new 1,000 gallon liquid nitrogen storage tank is necessary to replace an existing 30 year old tank that is in poor condition. The installation of the additional high pressure pump and gaseous nitrogen storage bottles will increase the capability of the facility to perform six test runs per day rather than the present four runs.

5. Repair Process Cooling Water Systems, Various Facilities..... 580,000

This project repairs the process cooling water systems serving various research facilities in the West Area of Langley Research Center. Included is the replacement of seven water storage vessels and associated piping serving building 1265; the replacement of an 1,800 gallons per minute (gpm) cooling tower serving Building 1293; and the replacement of a 3,300 gpm cooling tower serving Building 1146. The process cooling water systems components to be replaced under this project have been in service for approximately 30 years. Replacement of these cooling towers is necessary to reduce maintenance downtime and to ensure a reliable source of cooling water to research equipment in Buildings 1146 and 1293.

6. Replace Cooling Tower Serving the 8-Foot Transonic Pressure Tunnel..... 640,000

This project replaces the cooling tower serving the 8-Foot Transonic Pressure Tunnel. This includes demolishing the existing cooling tower; modifying the basin, piping, electrical service, fire protection systems and controls; and installing a new cooling tower. The cooling tower being replaced under this project provides a total of 12,950 gpm of cooling water to both research and HVAC equipment. It is a four-cell, wood tower that is approximately 40 years old. The deteriorated condition of the wood fill material has reduced the cooling capacity of the tower which prevents the 8-Foot Transonic Pressure Tunnel from operating at full capacity during the summer months. Replacement is essential to ensure uninterrupted service to this major research facility.

H. Lewis Research Center (LeRC)..... £3,590,000

1. Repair Steam Trenches, Taylor Road..... 500,000

This project provides for the repair and replacement of deteriorated sections of concrete steam trenches, condensate piping and pavement along Taylor Road from the Steam Plant (12) to Walcott Road. Deteriorated trench walls, manholes and pipe supports will be replaced. Plugged and corroded condensate piping, fittings and valves will be replaced. New insulation will be installed along existing steam pipe. Taylor Road will be resurfaced with new asphalt paving along the affected length of steam trench. Sections above the steam trench have collapsed exposing concrete trench covers and condensate pipe. The project will provide safe, reliable steam service to critical research buildings.

2. Repair Chilled Water Piping, Engine Research Building..... 500,000

This project provides for the repair of the chilled water piping in the Engine Research Building (5). The work includes removal of approximately 2,000 lineal feet of old 6 inch through 12 inch diameter asbestos insulated steel chilled water piping in the basement, and replacement with new fiberglass insulated steel piping. Other work includes miscellaneous mechanical and structural modifications as necessary. The piping in this project was installed during original building construction in 1950. Replacement will eliminate deterioration and erosion, reduce maintenance, and increase system reliability.

3. Repair Electric Power Distribution Tunnel..... 550,000

This project provides for the sealing of leaking ceiling and wall surfaces in the high voltage electric cable tunnel between Substation "B" and the Engine Research Building. Work will include sealing of leaking tunnel cracks, expansion joints, manholes and conduit penetrations. Existing drains and sump pumps will be rehabilitated to improve water drainage. Lighting fixtures and convenience outlets will be replaced to improve maintenance efficiency and safety. Electrical cable supports will be cleaned or replaced as needed. Continued deterioration will render this tunnel unsuitable to protect critical electrical distribution cables. The work will reestablish the tunnel as a safe, dependable route for underground electrical power distribution.

4. Repair HVAC, Basic Materials Laboratory (106)..... 680,000

This project will repair the HVAC system in the Basic Materials Laboratory (106). The work consists of removal of the existing dual duct heating/cooling and control boxes, installation of variable volume boxes

with controls, and installation of an air supply vortex damper with controls and replacing the laboratory roof mounted exhaust fans. Other work in this project includes miscellaneous mechanical, electrical and structural modifications as necessary. The HVAC system is the original system installed in 1962 and has been kept operating by frequent repairs. This project will eliminate the frequent shutdown periods for maintenance and correct the toxic fume exhaust safety hazard.

5. Repair HVAC, Energy Conversion Laboratory (302)..... 680,000

This project provides for the repair of the HVAC system in the Energy Conversion Laboratory (302). The work consists of replacing the fan/coil units, laboratory air handling units, roof mounted laboratory and toilet exhaust fans, process water heater, and existing boiler stack. Also included are installation of water system backflow preventors, potable water piping, and fire hose connection standpipes in place of the fire hose cabinets. Other work in this project includes miscellaneous mechanical, electrical and structural modifications as necessary. The existing HVAC systems were installed in 1961 and have been kept operating by frequent repairs. The toxic laboratory fumes are exhausted at roof level allowing recirculation into the building air intakes creating a safety hazard. This project will eliminate the frequent shutdown periods required for maintenance and correct the code violations and exhaust problems.

6. Repair Fire Water Distribution System, Plum Brook Station..... 680,000

This project provides for the repair of the fire water distribution system at Plum Brook. The work in the project includes replacement of approximately 8,000 feet of fire water piping, repair and/or replacement of inoperable valves and hydrants and installation of a pressure relief valve at the pumping station. The fire water distribution system serves all of Plum Brook Station. The system is 49 years old and requires continual maintenance. Currently the Hypersonic Tunnel Facility is scheduled for reactivation and use with LH₂. Reliable fire protection is required to minimize damage to experimental hardware and the facilities in the event of an accident.

I. Marshall Space Flight Center (MSFC)..... \$1,450,000

1. Repair High Pressure Piping..... 730,000

This project provides for the repair of portions of the high pressure fluid systems supporting major test areas and laboratories throughout the MSFC. Scope includes the repair of equipment, components, piping

and corrosion protection systems as required to meet current codes and operational/safety standards. Repair items are identified as part of the recertification program for pressure systems at the center. These systems support all of the major test programs at MSFC.

2. Repair Roads and Paved Areas..... 460,000

This project provides for the repair and resurfacing of approximately 80,000 square yards of deteriorated roads, parking areas and hardstands at MSFC. Scope includes repairing damaged base course, application of tack coats, overlaying with asphaltic paving and/or a seal coat, and painting of parking stripes and road markings. These road surfaces and hardstands provide primary access to key test, development, and production facilities.

3. Repair Computer Air Handling Unit (Slidell Computer Center)..... 260,000

This project provides for the replacement of obsolete and defective air handling units which provide environmental control for critical electronic equipment areas in Building 902. Scope includes replacement of eight existing units with their associated piping and controls. In spite of constant maintenance, frequent failures of existing units result in long downtimes of critical computer equipment due to the loss of cooling capability.

J. Michoud Assembly Facility (MAF)..... \$2,340,000

1. Repair Building 102, First Floor, West End..... 740,000

This project provides for repair of the interior systems of the Engineering Building (102) on the west end of the first floor. Scope includes replacement of the supply/return duct work, electrical distribution/cabling system, existing acoustical ceiling/lighting system, and modification of overhead sprinkler and fire alarm systems. This building is over 40 years old and has never received a major interior building restoration. These repairs are required to provide an adequate workplace environment.

2. Repair Building 101, Second Floor, West End..... 710,000

This project provides for repair of the interior systems of the Administration Building (101) on the west end of the second floor. Scope includes replacement of the supply/return duct work, electrical distribution/cabling system, existing acoustical ceiling/lighting system, and modification of overhead sprinkler and fire alarm systems. This building is over 40 years old and has never received a major interior

building restoration. These repairs are required to provide an adequate workplace environment.

3. Repair Demineralized Water Supply Line..... 450,000

This project replaces the demineralized water supply piping from the Demineralizer Facility to the Tank Farm. Scope includes replacing about 1,600 feet of 6 inch underground fiberglass piping with above ground stainless steel piping and modifying existing pipe racks to carry the additional load of the relocated piping. Frequent leaks caused by joint failures and settlement cracks plague the existing piping. The leaks disrupt the supply of demineralized water required for essential major component cleaning and surface treatment operations in the External Tank Manufacturing Building and in the Vertical Assembly Building.

4. Repair Air Handling Units, Enclosed Areas, Building 103..... 440,000

This project provides for the replacement of large packaged air handling units supporting production related enclosed areas within the External Tank Manufacturing Building. Scope includes the replacement of 10 units along with deteriorated duct work. This project completes a comprehensive plan to replace all deteriorated air handling units in Building 103.

K. Stennis Space Center (SSC)..... \$1,300,000

1. Canal and Waterway System Repairs..... 300,000

This project provides for the repair of damaged portions of the Stennis Space Center canal and waterway system which serves as the primary transportation artery for movement of rocket engines and fuel barges to test stands. Scope includes repair of approximately one mile of canal system embankments, several corrugated metal pipe drainage culverts and approximately three miles of canal access roads. Unimpeded water access to rocket engine test stands for hardware and fuel delivery is essential to continue rocket engine testing at SSC.

2. Replace Various Roofs..... 600,000

This project provides for the systematic replacement of roofs on Buildings 8100, 2105, 2204 and 2205. Scope includes a total of 227,750 square feet. All of the roofs are over 25 years of age and in advanced stages of deterioration. Major roof leaks are considered imminent.

3. Repair of Roads..... 400,000

This project provides for the repair of various deteriorated road segments totaling 5.5 miles in length. Scope includes the resurfacing and restriping of these roads, which contain approximately 68,900 square yards of road surface. Resurfacing will require 1.5 inches of bituminous material; shoulders will be sloped and dressed. Repair of these heavily traveled roads will improve safety, serviceability and prevent damage that would result in more costly repairs, if delayed.

L. Wallops Flight Facility (WFF)..... \$1,875,000

1. Repair of Seawall..... 700,000

This project provides for the repair of a segment of the Wallops Island seawall to protect launch support areas and associated facilities north of launch area 2. The repair work includes all necessary toe protection of the replaced seawall segments. This work is necessary to prevent or minimize storm damage which is becoming increasingly common due to beach erosion and escalating deterioration of the existing protection system.

2. Repair of Island Causeway Bridge..... 675,000

This project provides for complete rehabilitation of the Wallops Island Causeway Bridge which includes replacement of the substandard approach guardrails, repairing the cracked, spalled and delaminated sections of the pier caps, pier columns, abutments, safety curbs and parapets and coating of all exposed superstructure surface with a protective epoxy coating. The Wallops Island Causeway Bridge is the only vehicular link between the Island and Mainland facilities. The causeway bridge is used as an access structure for all major island utilities including electrical, telecommunications, and water service; both potable and fire protection. These repairs and improvements are necessary to protect the bridge from further deterioration and to insure the safety of personnel using the structure.

3. Repair of Aircraft Aprons..... 500,000

This project provides for the repair of deteriorated aircraft parking and refueling aprons east of Building D-1. The work will consist of placing a Portland cement concrete overlay on this area. Included in the work is the restoration of the existing drainage structures and proper pavement slopes. The aprons are primary for fueling operations and aircraft parking and have deteriorated to the extent that broken pavement presents foreign object damage hazard to aircraft and associated personnel. The existing asphalt pavement is

not resistant to jet fuel, hydraulic fluid and heat blast. The drainage structures need to be repaired in order to support anticipated aircraft traffic.

M. <u>Various Locations</u>	<u>\$500,000</u>
1. Repair Roofs, Merritt Island STDN Station, Florida.....	200,000

This project provides for replacement of the roofs on the Operations and Generator Buildings at the Merritt Island Spaceflight Tracking and Data Network (STDN) Station. Approximately 25,000 square feet of existing roofing will be removed and replaced with asphalt base sheet, flashing, coping, and gravel stop. These two buildings are 20 years old, with increasing leaks and required repairs it is necessary to replace the roofs to protect against ceiling, building, and equipment damage.

2. Repair Utility Systems, Bermuda STDN Station.....	300,000
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This project provides for the repair of portions of the salt water distribution system, the electrical power system, and the diesel generator fuel system at the Spaceflight Tracking and Data Network (STDN) Station in Bermuda. The underground piping, valves, and pressure tank will be replaced in the salt water system. The wiring from the generators to the switchgear and from the switchgear to Substation 1 will be replaced along with upgrading of switchgear with new instrumentation. In the diesel fuel system the interiors of two above-ground 15,000 gallon tanks will be recoated and fuel piping to the power plant will be replaced. The existing systems are approximately 25 years old and require major repairs. These repairs are necessary for Bermuda STDN Station to continue to provide reliable support to both manned and unmanned missions in the future.

<u>MISCELLANEOUS PROJECTS NOT IN EXCESS OF \$150,000 EACH</u>	<u>\$700,000</u>
Total	<u>\$30,000,000</u>

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

An estimated \$30,000,000 to \$33,000,000 per year will be required for the continuation of this essential repair program.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

SUMMARY

REHABILITATION AND MODIFICATION

Summary of Project Amounts by Location:

	<u>Amount</u>	<u>Page No.</u>
Ames Research Center.....	\$2,690,000	CF 14-3
Dryden Flight Research Facility.....	1,140,000	CF 14-4
Goddard Space Flight Center.....	3,145,000	CF 14-5
Jet Propulsion Laboratory.....	1,670,000	CF 14-7
Johnson Space Center.....	3,300,000	CF 14-8
Kennedy Space Center.....	3,310,000	CF 14-10
Langley Research Center.....	3,440,000	CF 14-11
Lewis Research Center.....	3,510,000	CF 14-13
Marshall Space Flight Center.....	3,655,000	CF 14-14
Michoud Assembly Facility.....	1,870,000	CF 14-16
Stennis Space Center.....	2,700,000	CF 14-17
Wallops Flight Facility.....	1,835,000	CF 14-18
Various Locations.....	435,000	CF 14-19
Miscellaneous Projects Not in Excess of \$150,000 Each.....	<u>1,290,000</u>	CF 14-20
Total.....	<u>\$34,000,000</u>	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Rehabilitation and Modification of Facilities, Not In Excess of \$750,000 Per Project

INSTALLATION: Various Locations

FY 1991 CoF Estimate: \$34,000,000

FY 1989: \$30,860,000

FY 1990: \$35,000,000

COGNIZANT INSTALLATIONS/LOCATIONS OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management

SUMMARY PURPOSE AND SCOPE:

These resources will provide for the rehabilitation and modification of facilities at NASA field installations and Government-owned industrial plants supporting NASA activities. Included in this request are those facility rehabilitation and modification needs for FY 1991 that have been fully identified at the time of the submission of these estimates and are estimated not to exceed \$750,000 per project. The purpose of this program may include some restoration of current functional capability but also includes enhancement of the condition of a facility so that it can more effectively accomplish its designated purpose or increase its functional capability.

PROJECT JUSTIFICATION:

Based on the initial investment costs, the NASA Capital Type Property totals approximately \$7.5 billion of which the physical plant comprises some \$4.1 billion. A continuing program of rehabilitation and modification of these facilities is required to accomplish the following:

- a. Protect the capital investment in these facilities by minimizing the cumulative effects of wear and deterioration.
- b. Ensure that these facilities are continuously available and that they operate at peak efficiency.
- c. Improve the capabilities and usefulness of these facilities and thereby mitigate the effects of obsolescence.
- d. Provide a better and safer environment for all personnel.

This program includes only facility rehabilitation and modification work having an estimated cost not in excess of \$750,000. The work is of such a nature and magnitude that it cannot be accomplished by routine day-to-day facility maintenance or by related routine facility work efforts that are provided for in other than CoF estimates.

PROJECT DESCRIPTION:

Proposed rehabilitation and modification projects for FY 1991 totaling \$34,000,000 are described under "PROJECT COST ESTIMATE." The total program of \$34,000,000 has been distilled from requests of approximately \$55,000,000 and represents only a modest request in relation to the backlog of this type of work. Based on relative urgency and expected return on investment, the projects which comprise this request are the highest priority requirements. Deferral of this mission-essential work would adversely impact the availability of critical facilities, program schedules, and energy conservation objectives. Only those projects estimated to cost not in excess of \$150,000 have not been individually described or identified by center. The total cost of these miscellaneous projects is \$1,290,000.

During the course of the year, some rearrangement of priorities may be necessary. This may force a change in some of the items to be accomplished. Any such change will be accomplished within available resources. The following broad categories of work are described further in the "PROJECT COST ESTIMATE:"

a. Utility Systems.....	\$ 8,370,000
b. Fire Detection/Protection Systems.....	4,055,000
c. General Purpose Buildings.....	6,570,000
d. Technical Buildings/Structures.....	14,605,000
e. Pavements and Drainage.....	400,000

PROJECT COST ESTIMATE:

A. <u>Ames Research Center</u> (ARC)	<u>\$2,690,000</u>
1. Rehabilitation & Modification of the Fire Suppression System (N-221).....	400,000

 This project will rehabilitate the wet pipe fire suppression systems in Buildings N221 and N221B. Several existing wet pipe sprinkler systems are non-functional due to extreme vibrational damage. The project will replace damaged sprinkler systems and provide additional fire suppression systems in previously unprotected office and warehouse areas. Fire Prevention Inspection Reports and Fire Safety Surveys validate the necessity of doing this work now. Failure to implement this project will leave the facility below required minimum level of safety.

2. Rehabilitation and Modification of Utility Systems (N-243).....	740,000
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 This project will replace and upgrade building utilities in N-243 to support ongoing flight simulation research activities. The project includes replacing the cooling tower with a higher capacity unit, upgrading the chilled water plumbing, installing a new 400 ton chiller, and providing enhanced monitoring and control to enable load shedding of non-critical loads, and provide additional monitoring of critical building utilities. The project will also correct reliability and capacity problems with the building HVAC. These problems have caused interruptions and delays to ongoing flight simulation research. The aging equipment and expansion of demands over the years have resulted in these systems being unable to support peak loads. Enhanced reliability and additional cooling capacity are critical needs in this budget cycle.

3. Modification of Shop and Office Areas (N257).....	470,000
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 This project will combine shop functions, consolidate personnel office space by combining Rooms 113 and 114, create a corridor along one side of the Computer Lab and a corridor and entry door to the Human Performance Research Laboratory, expand the shop area by adding a 700-square-foot mezzanine, and install an overhead bridge crane in the High Bay area. A major role of the Man-Vehicle Systems Research Facility (MVS RF) (N257) is to host human factors full-mission simulation experiments in current and future technology commercial aircraft simulators. The emergence of the facility from its development phase to its current national reputation for innovative research has also resulted in larger staff needs. For example, the new Aviation Safety/Automation Research and Technology (R&T) augmentation will significantly increase the demand for simulation time and the operations staff in the MVS RF over the next five years. In order to adequately accommodate these program increases it is necessary to modify the existing workspace.

4. Replacement of Power Transformer (T90)..... 740,000

This project will replace an existing, 5 MVA transformer with a 10 MVA dual voltage transformer, upgrade an existing underground 6,900 volt cable to 15,000 volts within the substation, and retrofit existing 6,900 volt switchgear. General building power load requirements at the Center have increased greatly since the original installation of a dual 6.9 kV system which feeds main frame computers, HVAC systems, and general lighting and power loads of 34 buildings at Ames. Although the two systems can be tied together, the transformers cannot handle the entire load. These upgrades to the system will significantly improve the efficiency, capability, and redundancy of the substation.

5. Modification of the Main Substation Tie Breaker..... 340,000

This project provides a steel tower structure, buswork, air switches, instrumentation, and wiring to modify an existing oil circuit breaker to a load switching tie breaker. Load switching at the 115 kV substation is currently performed with the existing overhead air switches. This new tie breaker will assure an equalized potential on each bus when switching and will prevent arcing and switching burnout which has occurred in the past. The utility company has successfully used a similiar tie breaker in their adjacent substation to reduce arcing.

B. Dryden Flight Research Facility (DFRF)..... \$1,140,000

1. Rehab, Air Conditioning System, Building 4800 - Area B..... 740,000

This project provides for the replacement of a constant volume, variable temperature heating/cooling system with a constant temperature variable volume system in 22,000 square feet of the first and second floor of Building 4800. Existing supply and return fans will be replaced. All existing duct work and air diffusion devices will be replaced and dual duct variable volume terminal boxes will be added to provide adequate zoning and flexibility. The existing system was installed in 1955 as an evaporative cooling type system and has been subsequently modified and adapted to a mechanical refrigeration system. There have been numerous room reconfigurations, occupancy changes, loss of system balance, and deterioration of control systems. Replacement of these worn out systems will greatly enhance the quality of the workplace environment and provide decreased maintenance expenditures.

2. Backup Power System (4720)..... 400,000

This project provides a 225 kW Uninterruptable Power Supply for 15 minute backup, and a 400 kW standby generator with automatic transfer switch. Aeronautical Tracking Facility #2 is the prime tracking Facility for Space Transportation System (STS) landings at Edwards Air Force Base. Presently only commercial power is

available with no back-up in the event of failure. In order to provide reliable power for critical Shuttle operations, this back-up power system is required now.

C. Goddard Space Flight Center (GSFC)..... \$3,145,000

1. Modifications for Office, Warehousing and Support Space,
Various Buildings..... 630,000

This project provides for the modification of 11,000 square feet in the Space Projects Facility, Building 1; 12,000 square feet in the Logistics and Supply Facility, Building 16W; and 18,000 square feet in the Space and Terrestrial Applications Facility, Building 22. Work to be accomplished includes demolition of existing partitions and installation of new ones, modification of air conditioning, power, lightning, fire protection and detection systems. Space in Building 1 will support the Center's employee development activities. Recovered space in Building 16W will accommodate flight hardware storage requirements of several flight projects. Space in Building 22 will be backfilled by other elements of Space and Terrestrial Science now housed in warehouse space in Building 16W. This project will make effective and efficient use of 41,000-square-feet of building space that was vacated by the Science Directorate which was moved to the Technical Processing Facility, Building 28.

2. Modifications to Technical Support Building (19)..... 500,000

This project provides for the rehabilitation and modification of Building 19 to support instrument development, engineering, and processing activities. Building electrical distribution, air conditioning, heating and ventilation systems will be brought up to current standards and reconfigured. Liquid nitrogen and compressed air service will be provided to laboratory spaces. Architectural modifications will include seismic isolation and radiofrequency shielding of certain lab areas, special finishes to achieve a "clean room" environment in several labs, and minor upgrades/modifications to office/support areas. This project supports the consolidation of the Instrument Division into the Buildings 19/20 area. The basic electrical distribution and mechanical systems in the building are 25 years old and must be rehabilitated to provide acceptable environmental control and reliable operation. The use of the building has changed a number of times and reconfiguration of these systems is essential to meet current requirements.

3. Modification for Launch Support Activities
in Space Sciences Laboratory (6)..... 315,000

This project proposes the modification of approximately 4,500 square feet of space in the second floor west wing of Building 6 to house additional personnel associated with the Earth Observing System (Eos) project. Project staff is expected to grow from 10 people to at least 85 people by FY 1992. In addition,

CF 14-5

repairs will be made to the interior of Building 6 on all floors as needed to bring the building up to acceptable standards. Modifications include removal of existing partitions and construction of new partitions, replacement of obsolete metal pan and/or surface mounted ceiling systems with lay-in acoustic ceilings, replacement of obsolete fluorescent light fixtures, replacement of worn and obsolete floor tiles, and repainting of existing walls and partitions. Extension of sprinkler heads and modifications to HVAC and electrical distribution systems will also be required in conjunction with ceiling replacement. This project is required to accommodate growth of personnel supporting the Eos program at Goddard Space Flight Center as it moves into critical design and development phases in FY 1991.

4. Modifications of Fire Protection Systems, Various Buildings..... 700,000

This project includes the modifications and upgrades to the existing high voltage fire detection systems in thirteen buildings. The buildings numbers are 1, 3, 5, 6, 7, 8, 10, 13, 14, 15, 16, 16W and 17. The replacement equipment will include low voltage fire detection systems, annunciator panels, wiring and smoke detectors. This existing high voltage fire detection system is obsolete and replacement parts are not available. In order to comply with current safety standards and provide reliable operation, upgrading to a low voltage system and replacing obsolete equipment are required.

5. Modifications to Optical Test Facility in Building (5)..... 300,000

This project proposes modifications to architectural, electrical and mechanical systems in the Building 5 Optical Test Facility to isolate the existing 36-inch precision auto collimation system from local vibration. Modifications will include construction of a 48-foot long x 12.5-foot wide x 6-foot deep trench in the floor of the Optical Test Facility to accommodate the installation of an air suspension/isolation system and optical bench. Steel pit covers will be used to enclose the accessway between the isolation block and ground slab. Access is required to maintain isolators. This project will permit installation of equipment necessary to meet the demands of more sophisticated new optical systems that must be collimated in the Optical Test Facility.

6. Rehabilitation and Modification of Data Interpretation Laboratory (23)..... 700,000

This project provides for the rehabilitation and modifications to the first and third floor of Building 23 to provide data and image processing support. The work will include reconfiguration of partitions, new ceiling systems, modification of lighting, power, air conditioning and fire detection/protection systems. Building 23 is approximately 25 years old and has not been upgraded since its original construction. The proposed work will provide required facility changes to effectively support computer operations in this building for remote sensing program activities.

D. Jet Propulsion Laboratory (JPL)..... \$1,670,000

1. Modifications to Electrical System, Computer Program Office (156)..... 250,000

This project provides for electrical modifications of Building 156 electrical power system by the addition of a new transformer for the existing 480 volt distribution panel. This new transformer will provide dedicated power to nine existing computer laboratories and data rooms. The function of Building 156 has changed by conversion of several office areas to small flight hardware electronics systems and computer laboratories to test spacecraft subsystems. Existing small power distribution panel boards serving the electronic and computer equipment are subject to power line disturbances caused by the air handling systems, small motors, and service receptacles throughout the building. These electrical problems will be eliminated by providing a separate, dedicated power electrical feeder with distribution to each computer laboratory and data room.

2. Modifications to Wind Tunnel Building (79)..... 700,000

The project provides for modifications to the easterly segment of Building 79. The modifications will produce approximately 8,000 square feet of storage and technical space. The project includes removal of obsolete heavy equipment and supporting utility/structural systems. A new air conditioning system, revised electrical power and lighting system, a modified steel mezzanine floor and stairs and new access doors will also be provided. Building 79 formerly housed the 20 inch wind tunnel test section, compressors and supporting operating equipment. Since the removal of the test section in the early 1980's, the westerly segment of this building was converted into office use. The relocation of the 21 inch wind tunnel in 1988 permits the removal of compressors from the easterly segment of Building 79 and converting the area into needed usable space.

3. Modifications of Second Floor, Administration Building (180)..... 720,000

This project provides for the modification of approximately 7,500 square feet of the second floor of Building 180. This modification will incorporate the south hallway to provide more efficient space utilization and provide approximately 1,000 additional square feet of usable office space. Demolition of partitions and modification of the existing electrical system are included in the project. New drywall partitions will be constructed. This project also includes the removal of friable asbestos fireproofing above the office areas, new fireproofing, and encapsulating the plenum area over the restrooms. New suspended grid acoustical ceilings will be installed over the office areas and new drywall ceilings will be installed over the lobby area.

E. Johnson Space Center (JSC)..... \$3,300,000

1. Modifications for Crew Training..... 700,000

This project provides for modifications to the first and third floors of the Mission Simulation and Training Facility, Building 5. The first floor modifications include the installation of approximately 2,000 square feet of computer flooring, air handlers, and power distribution units. Modifications to the third floor include the installation of approximately 6,000 square feet of computer flooring, air handlers, and power distribution units. The third floor work also includes increased lighting and the addition of a wire-mesh supply room. This project will provide necessary space to accommodate trainers needed for the Space Station Freedom operations assured crew return capability. This facility is necessary to accomplish the Space Station flight crew and ground controller procedures development and training responsibilities.

2. Rehabilitation of Mass Spectrometer Chemical Laboratories (31)..... 550,000

This project provides for the rehabilitation of the mass spectrometer chemical laboratories in the Planetary and Earth Sciences Laboratory, Building 31. The work includes replacement of the existing deteriorated ceiling, laboratory benches, cabinets, door hardware, plumbing fixtures, and other metallic items. The project will also include modifications to the exhaust and air-conditioning systems and repainting of all rooms. The project will provide for the installation of approximately six clean work benches, asbestos abatement, and re-fireproofing of the structural members in the laboratory. This work is necessary to prevent the contamination of existing and future irreplaceable extraterrestrial samples which are studied in these laboratories. Acid fumes have damaged exposed metal surfaces causing the presence of loose dust and corrosion products which pose contamination hazards to the samples as they are processed.

3. Modifications for Fire Safety (45)..... 600,000

This project provides modifications to Building 45 to assure a more acceptable level of fire safety. Automatic sprinkler piping and heads will be added throughout the first floor area. The corridor between the southeast stairwell and the northeast building exit will be upgraded to 2 hour fire-resistive walls, and the exit doors will be fire rated. Additionally, a smoke detection system will be installed in the first floor elevator lobby to recall the elevators to ground level upon detector actuation. This project also includes asbestos abatement and disposal on the first floor of the building. This work provides a level of fire safety equivalent to National Fire Protection Association Egress Standard for this seven-story office building.

4. Installation of Automatic-Sprinkler System (31)..... 400,000

This project provides for the installation of an automatic sprinkler system in the Planetary and Earth Sciences Laboratory, Building 31. Approximately 70,700 square feet of office and laboratory high bay area will be protected by the sprinkler system. Work includes installation of approximately 600 sprinkler heads arranged in four zones, one for each floor in the office area and two for the high bay area. All isolation valves, drain lines, and alarms will be included in the project. The work also includes the spot removal of asbestos in the ceiling of the laboratory and office area and a portion of the high bay area to facilitate installation of the sprinkler system. Provisions will be made to provide an adequate water supply to the building for the sprinkler systems. This project is required to provide a level of fire safety equivalent to National Fire Protection Standards for this building which contains laboratory, office, and lunar sample investigation areas.

5. Rehabilitation of Fire Detection Alarm System (001) 350,000
NASA Industrial Plant, Downey, CA

This project rehabilitates the existing obsolete fire detection and alarm system in Building 001 at the NASA Industrial Plant, Downey, California. The work will include replacing the existing fire control panels, detectors, alarms, and wiring in Building 001 with a new, improved system. Also included is replacement of the system communication conductors to the Building 014 fire station. Replacement parts for the existing system must be made by hand, are disproportionately expensive, and require approximately one year for delivery.

6. Modify Public Affairs Facility (2)..... 250,000

This project provides for modifications to the south end of the auditorium, Building 2, to include repair of the existing plaster ceiling, construction of partitions, additional lighting, electrical power and air conditioning, restroom and floor repairs, and painting. The work is necessary to provide adequate facilities to accommodate the public and the large number of news media representatives who cover manned space flight missions.

7. Install Utility Air Systems Compressor (28)..... 450,000

This project provides for the installation of a centrifugal compressor, rated at 2,000 standard cubic feet per minute, with associated dual air dryers, piping, and controls, in the Auxiliary Chiller Facility, Building 28. Electrical modifications will include installation of a new 1,000 kVA transformer. The existing system is old and has insufficient capacity to support planned new facilities. Addition of the new compressor is the most cost effective way to assure needed capacity and reliability.

F. Kennedy Space Center (KSC)..... \$3,310,000

1. Rehabilitate Bridges Electrical Control Systems..... 590,000

This project replaces the existing magnetic amplifier controllers for each of the two Indian River Bridges and the Haulover Canal bridge with new variable speed motors and programmable controllers. The project includes replacement of related limit switches and control desks for each bridge. The existing control systems are antiquated and spare parts are not readily available. Spares must be hand made on an as needed basis which requires high costs for tool-up and long lead procurement times. These replacements are necessary to maintain operations and reliability of these bridges.

2. Upgrade Railroad Mainline and Railroad Bridge to JJ Yard..... 715,000

This project provides for replacing existing sectioned rail from the east end of the railroad bridge eastward approximately 2.3 miles, and a short track at JJ Yard. Work consists of installing new 132-pound welded rail and four new switches. The KSC mainline rail system is structurally marginal for the solid rocket motor segment rail cars (250 ton). Replacement of existing rail with 132-pound welded rail will increase rail strength and decrease rail wear and maintenance requirements.

3. Refurbish Ground and Elevated Water Storage Tanks..... 300,000

This project provides for refurbishment of the 1,000,000 gallon ground storage tank and 250,000 gallon elevated tank at the Vehicle Assembly Building and the 250,000 gallon elevated storage tank located in the KSC Industrial Area. Work includes new or upgraded cathodic protection systems, and recoating interiors and exteriors with epoxy paint. These tanks are approximately 25 years old and have never been refurbished. The total KSC potable and fire suppression water systems rely on the integrity of these tanks to maintain a safe and reliable storage system to meet KSC water requirements. Continued use of these tanks without refurbishment could result in health hazards or loss of water for Shuttle processing and facility fire protection.

4. Modify Air Conditioning Control System, Operations and Checkout (O&C) Building..... 340,000

This project will replace the O&C building air-conditioning electro-pneumatic control system with Programmable Logic Controllers (PLCs), and modify the existing control console assemblies to accept the new system components. The existing control system wiring and components are severely worn and in some cases obsolete. The existing system is being remotely controlled and monitored by the Central Control System which does not provide a means to derive system parameters (e.g., temperature, flows, pressures, efficiency, energy consumption, etc.). Replacement of the system with a PLC system will provide a totally automated control

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system, with high reliability and flexibility, more efficient operation, greater visibility and reduced down time due to a failure.

5. Modify LC-39 Emergency Power Generation Plant..... 500,000

This project provides for upgrading the switchgear and bus work at the LC-39 emergency power plant to state-of-the-art equipment. Work will consist of replacing switchgear with modern vacuum circuit breakers and upgrading the bus work to larger capacity bars. The existing switchgear was manufactured in Europe in the early 1940's and the manufacturer can no longer supply parts. The bus connecting the power equipment is mounted on obsolete phenolic resin insulators. Maintenance tests show the dielectric strength of the insulators is seriously deteriorated. Replacement of these obsolete components will improve the reliability of this system and avoid impacting Shuttle processing schedules.

6. Rehabilitate Pad B Fire Detection, Alarm and Reporting System..... 485,000

This project will replace all of the original fire alarm system including conduit, wires and cable with a new integrated system which meets current National Electrical Code (NEC), National Fire Protection Association (NFPA) and KSC standards. The existing Pad B fire detection, alarm and reporting system is badly deteriorated and inadequate to provide proper support for planned STS launches. This system is approximately twenty years old and replacement parts are difficult to obtain. Maintenance cost and down times are continually increasing and this will cause an adverse effect on the STS launch schedule. Conduit and wires are badly corroded or deteriorated and are in danger of failure.

7. Refurbish Water Chiller #3, VAB Utility Annex..... 380,000

This project provides for refurbishment of the condensor gear box and pumpout system of VAB Utility Annex Chiller #3. The work will include refurbishing and retubing the condensor, reworking the compressor gearbox and pumpout system, and replacing associated piping and insulation. The existing equipment is over 22 years old and many of the components need refurbishment. This project will increase the chiller's efficiency and assure reliable operations.

G. Langley Research Center (LaRC)..... \$3,440,000

1. Modifications to the Mach 6 and Mach 8 Air Distribution Systems..... 700,000

This project provides for modifications to upgrade the controls for the Mach 6 and Mach 8 air distribution systems in Building 1247D. The work to be accomplished includes the installation of all hardware and software necessary for a microprocessor based system which will automatically control the temperature,

pressure, and flow of air distributed to the facilities served by these high pressure air systems. The proposed automated control systems will reduce the number of operators from four to one, increase pressure and temperature set point accuracy, and increase operating efficiency by reducing the time required to reach programmed set points.

2. Modifications to Hypersonic Nitrogen Tunnel (1247B)..... 610,000

This project provides for modifications to upgrade the Hypersonic Nitrogen Tunnel (HN₂T) located in Building 1247B. The work to be accomplished under this project includes the fabrication and installation of a Mach 13.5 nozzle assembly and a new heater element. The tungsten heater element which is located in the settling chamber will be replaced with a higher capacity, longer life element to provide for a higher mass flow rate and more dependability. This project will provide additional capability to the HN₂T and Hypersonic Complex Facility, and fill a void in the Mach number range for NASA hypersonic wind tunnels. The upgraded heater element is required to improve the reliability of the heater and the overall reliability of the HN₂T. Implementation of this project as scheduled is critical in order to proceed with presently scheduled research and to ensure NASA's ability to provide critical hypersonic research support for future initiatives.

3. Modifications to Spacecraft Components Laboratory (1239A)..... 720,000

This project provides for modifications to the spacecraft components laboratory in Building 1293A in LaRC's west area. The area to be modified is approximately 5,500 square feet and has an unobstructed height of approximately 69 feet. The modifications include the installation of approximately 5,100 square feet of raised deck flooring in the high bay area and approximately 3,800 square feet of aluminum planking on the existing space frame structural support system in the high bay area. An 800-square-foot control room with raised deck flooring and a dedicated HVAC system will be constructed in the high bay area. An elevator to provide access to the space frame structural support system will also be installed. This project also provides for upgrading the power distribution, lighting, and fire alarm systems; modifying the plumbing system; installing a one-half ton monorail hoist; and providing a new passageway for moving models into the high bay area. The proposed modifications will provide the access required for the efficient and safe installation of models in the high bay area; an appropriate control room to accommodate research personnel and equipment; and a level, unobstructed floor area in the laboratory.

4. Rehabilitation, Simulation Research Facility (1220)..... 680,000

This project provides for the rehabilitation of approximately 7,500 square feet of first and second floor office and laboratory space in the Simulation Research Facility (1220). The rehabilitation will include: the demolition of deteriorated building components; the installation of new interior walls, windows, floors, ceilings, stairwells and rest rooms; the installation of new light fixtures and fire alarm system components; upgrading the electrical power distribution system; and modifying the heating, ventilating, and

air-conditioning systems. The area to be rehabilitated is in a severely deteriorated condition and its use as office and laboratory space is marginal. This project will provide a suitable environment and central location for the research personnel and equipment in the Automation Technology Branch.

5. Modifications to the 20-Inch Supersonic Wind Tunnel (1247D)..... 730,000

This project provides for modifications to the 20-Inch Supersonic Wind Tunnel. The work to be accomplished under this project includes the fabrication and installation of a new test section cabin and a model injection/support system. The proposed model injection/support system will provide vertical injection/retraction of models during tunnel operation; angles of attack from -10 degrees to +40 degrees; yaw angles from - 10 degrees to +10 degrees; and will be capable of manual or automatic operation. The new test section cabin will eliminate the troublesome inflatable seals. This project will increase the efficiency of operations and enhance the effectiveness of this tunnel.

H. Lewis Research Center (LeRC)..... \$3,510,000

1. Rehabilitation of LN2 System, Space Power Facility (SPF) Plum Brook..... 720,000

This project will provide for the rehabilitation of the Space Power Facility's gaseous nitrogen compressors and LN2/GN2 distribution system. The work includes rehabilitation of the compressors, aftercoolers, valves, instruments and controls. Other work includes miscellaneous electrical, structural and mechanical rehabilitation as necessary. The Space Power Facility's cryogenics system is required to be operational to support testing requirements of the Space Station Freedom Program. Completion of this project will restore the thermal operating capability of this largest thermal vacuum chamber in the free world.

2. Modifications for Advanced Dynamic Power Facility, Engine Research Bldg. (5)..... 690,000

This project will modify test cells SE-4, SE-6, and SE-8 to provide an Advanced Space Power Testing Facility in the Engine Research Building (5). The work includes the installation of a 480 VAC distributed power panel, a 200 kW electrical power source, a 150 kW heat sink, a 50 kW alternator dynamometer, facility controls and instrumentation, and facility utilities. Other work includes miscellaneous structural and mechanical modifications as necessary. This facility will enable the testing of a broad range of dynamic space power systems including Advanced Stirling Engine development for space power.

3. Modifications for Research Test Chamber, EPRB (16)..... 680,000

This project provides for modifications to the Electric Propulsion Research Building (EPRB) (16) to provide an Ultra High Speed Thermal Vacuum Facility. The work includes: installation of government furnished

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equipment, including an 8 x 15 foot vacuum chamber with cold wall, diffusion pumps, blowers and roughing pumps; construction of the vacuum pumping system, including new vacuum piping and combination blower/roughing pumps; installation of a new LN2 piping system to serve the vacuum chamber; construction of a facility working platform; and installation of a control room, including controls and instrumentation. Other work includes necessary electrical, mechanical and structural modifications as necessary to complete this project. The Ultra High Speed Thermal Vacuum Facility is required to be operational in FY 1992 to meet LeRC's Space Power and Propulsion R&T program testing commitments.

4. Modifications to 2.4KV Switchgear, Sub B (13)..... 720,000

This project provides for the rehabilitation of the 2.4 kV switchgear in Substation B (13). The work includes the replacement of twenty 2.4 kV outdoor metal clad switchgear units with modern switchgear. The oil filled power circuit breakers used in this switchgear will be replaced with either magnetic or vacuum type circuit breakers. Remote signal transmission and new instrument transformers, metering and protective relaying will also be provided. Other work includes miscellaneous electrical and structural modifications necessary to complete the full intent of this project. The existing metal clad switchgear is over 48 years old and replacement parts are no longer available. The new switchgear will provide more reliable service and reduce the amount of maintenance required to keep this equipment in operation.

5. Rehabilitation of Mechanical Systems, Zero-G Facility (110)..... 700,000

This project consists of the rehabilitation of the mechanical systems at the Zero Gravity Facility (110). The work includes: the rehabilitation of the office and control room area; rehabilitation of the building heating/cooling systems; rehabilitation of the clean room HVAC and distilled water systems; rehabilitation of the overhead crane and controls; rehabilitation of the vacuum system including cooling water system; and the installation of a women's toilet. The systems are more than 25 years old and are now experiencing frequent breakdowns. The work in this project will eliminate costly and disruptive maintenance problems and provide reliable systems.

I. Marshall Space Flight Center (MSFC)..... \$3,665,000

1. Modifications for Marshall Avionics Systems Test Bed..... 655,000

This project provides for modifications of the West section of Building 4476 to provide an area for an avionics hardware simulation laboratory. Scope includes raised floor for simulation computers, HVAC, 208/440 volt power supplies, laboratory support electrical and mechanical systems and a 50 kV uninterruptible power source. The facility is required to test and evaluate advanced avionic architectures as well as system engineering design criteria for the entire range of space transportation systems under NASA's cognizance.

2. Modifications to Sunspot Pumping System..... 300,000

This project provides for modifications to the Thermal Vacuum Facility in the Environmental Test Facility (Building 4619) to achieve the higher levels of vacuum required to conduct highly sensitive optic component test and check-out. Scope includes installation of a 48-inch gate valve, numerous cryogenic pumps including a 12 inch turbomolecular system, and supporting control and gas supply/evacuation systems. The facility modifications are required to allow testing of the increasing number of flight hardware components that utilize mirrors and optics; such testing requires an ultra clean oil free environment which can only be achieved with cryopump systems.

3. Modifications for AXAF Operations Control Center..... 730,000

This project provides for modifications to the second floor of A and M wings, Building 4663, to accommodate the Advanced X-ray Astrophysics Facility (AXAF) Operations Control Center (OCC). Scope includes relocation and addition of walls, raised flooring, new power distribution and improved HVAC/lighting systems. The facility modifications will allow the integration of the OCC with the Huntsville Operations Support Center/Payload Operations Control Center to provide cost effective operations through shared resources in the areas of communications systems, data systems, reliable building systems and operating staff.

4. Modifications to Security Headquarters..... 740,000

This project provides for modifications to the interior and exterior of the Security Headquarters, Building 4312. Scope includes removal of exterior asbestos siding, application of a new siding material, roof replacement, window replacement and upgrade of floor, wall and ceiling surfaces. An additional 1,800-square-feet of space will be built and 7,000 square feet will be renovated. The facility modifications will allow separation of routine security functions (fingerprinting, badging, hardware storage), the base alarm control/maintenance area, and visitor reception.

5. Modifications of Deionized Water System, 4700 Area..... 500,000

This project provides for the rehabilitation of the deionized water system in Building 4707 and its adjacent 500,000 gallon storage tank. Scope includes upgrading of deionizers, filters and plumbing and replacement of deteriorated foundations and controls. The interior lining of the large storage tank will be inspected and repaired. Pumps, valves and lines necessary for supplying deionized water will be added. The facility modifications will result in a higher quality and higher quantity of deionized water required by the Ground Control Experiment Laboratory to support Space Station Freedom, Spacelab and other flight experiments.

6. Rehabilitate Plating Area and Chemical Laboratory (4760)..... 740,000

This project provides for the rehabilitation of Building 4760. Included is the upgrading of the small tank line used for electroplating processes and the chemical laboratory. Also included are cleaning, painting, repairing and insulating tanks; replacing deteriorated plumbing pumps and tanks; upgrading overhead hoist and electrical systems; and replacing deteriorated rectifiers. The chemical laboratory rehabilitation will require new lights and ceiling, replacement of floor tile and cabinets, and upgrade of the air-conditioning system. The plating capability of Building 4760 provides basic support to manufacturing and test activities throughout MSFC.

- J. Michoud Assembly Facility (MAF)..... \$1,870,000

1. Modify for Check Valves in Main Fire System..... 270,000

This project will prevent false signals/alarms from the fire sprinkler system in the External Tank Production Building 103. Scope includes installation of approximately 65 eight-inch and 15 six-inch water flow alarm check valves in the riser piping in Buildings 102, 103, 104 and 103. External Tank production is conducted within a 43 acre building. A low false alarm rate and ability to quickly isolate the location of a fire is critical within such a large manufacturing/operational complex.

2. Rehabilitate Steam Supply System..... 550,000

This project continues an overall plan to ensure mechanical reliability of the steam system supplying critical processes and HVAC needs in the External Tank Production Buildings 103, 110 and 114. Scope includes replacement of approximately 3,900 linear feet of two-inch to four-inch pipe and valves on steam mains, and installation of drip legs on five supply mains. Maintenance of critical environmental limits in the 43-acre production building has been jeopardized by the deterioration that has occurred since these lines and valves were first installed in 1943.

3. Rehabilitate and Modify Chilled Water System..... 740,000

This project provides for rehabilitation of the chilled water system supporting HVAC for the External Tank Production Building 103. Scope includes inspection, repair, and installation of flexible liner in approximately 1,500 linear feet of underground chilled water return lines. The scope also includes the replacement of "tee" and "wye" fittings in the return lines. Maintenance of critical environmental limits in the 43-acre production building has been jeopardized by the prevalent cracks and broken pipe sections existing in this piping system.

4. Rehabilitate and Modify Cooling Tower..... 310,000

This project provides for rehabilitation and enlargement of Cooling Tower 321. Scope includes replacing the existing single cell tower with a dual cell tower, foundation and associated equipment. Increase in cooling demand has exceeded the capacity of the existing cooling tower, and it is unable to maintain the environment required during the summer months in building 320.

K. Stennis Space Center (SSC)..... \$2,700,000

1. Rehabilitation of the Stiffleg Derrick - B Test Stand..... 700,000

This project provides for the rehabilitation of the 25 year old main Stiffleg Derrick on the B Test Stand (Building 4220). Scope includes the replacement of corroded and antiquated control circuitry with state-of-the-art solid state circuitry. The operator's cab will also be relocated. Safety, reliability and repairability of this unique Space Shuttle Main Engine Test Stand are required to adequately support current and future test programs.

2. Modify High Temperature Hot Water Generating System, South Administrative Area..... 740,000

This project provides for the installation of natural gas-fired hot water generators in the administrative complex Buildings 1000, 1002, 1100, 1105 and 1110. Scope will include gas supply piping, controls, water piping and ancillary equipment. This project will result in a significant reduction in operating cost compared to the existing oversized and leaking central heating system.

3. Rehabilitate Cryogenic and High Pressure Gas Piping..... 240,000

The project provides for the rehabilitation of the High Pressure Gas Facility (Building 3305). Scope includes reinsulation of all cryogenic, hot water, and high pressure gas piping; rehabilitation of the concrete pads and foundations; and 250 linear feet extension of the liquid nitrogen vent line. Long term deterioration of this vital industrial facility has reached the extent where it is no longer economical to continue preventative maintenance and repairs. Also, timely rehabilitation will reduce the increasing likelihood of a major structural failure.

4. Rehabilitate Cafeteria Kitchen, Building 1100..... 630,000

This project provides for the renovation of the cafeteria kitchen located in Building 1100 (the Administrative Building). Scope includes the rehabilitation of the food preparation area, upgrade of the deteriorated cold storage area and lighting system and the installation of a new HVAC system. Also included

will be the reconfiguration of the food serving line and additional seating for 180 people. The population increases at the Stennis Space Center require this increase in both the serving and seating capacity of this 20-year-old cafeteria.

5. Replacement of "B" Complex Main GH2 Vent Line..... 390,000

This project provides for replacing 450 linear feet of deteriorated aluminum pipe from the main "B" test stand area to the flarestack. The new pipe will be stainless steel which is more compatible with hydrogen. The GH2 ventline and flarestack are an essential safety component of the "B" Complex facility. This stand is used for ongoing research, test and development of the Space Shuttle Main Engine.

L. Wallops Flight Facility (WFF) \$1,835,000

1. Modifications for Control Center Support..... 740,000

This project provides for the modification of buildings E-106 and E-107 adjacent to the Integrated Range Control Center (IRCC). The work will include modifications to partitions, the installation of an airfield viewing area, and an independent electrical power system with related interior finishes, flooring, and electrical/mechanical systems. This area will house support elements including weather, wind weighting, safety, security, project management and airfield observation. It will allow the most effective use of existing space to support the Integrated Range Control Center (IRCC) through the location of all related personnel and equipment within a consolidated support complex.

2. Modifications for Fire Protection, Various Buildings..... 350,000

This project provides for the rehabilitation and modification of fire protection systems on the Main Base and Island. The work includes the installation of wet pipe sprinkler systems with piping, panels, and controls in Buildings F-10, C-15, N-167, and N-168 on the Main Base and Buildings V-45 and V-55 on the Island. The project also includes the upgrading of the Main Base fire protection system by upgrading alarm communications system and installing multiplexers. The present fire alarm system has marginal capacity and works intermittently. Upgrading the Main Base system will provide the capability to multiplex zone data directly to the Fire Station Central Alarm Panel. Building C-15 (Fire Protection and Prevention Facility), V-45 (Horizontal Facility), and V-55 (Vertical Balancing Facility) have no sprinklers. Building N-167 (ADAS Data Acquisition Building) and N-168 (ADAS Tracking Antenna Pedestal Building) require fire protection due to critical operations. Building F-10 requires an expansion of its existing wet pipe system with panels, controls, and alarms.

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3. Rehabilitation and Modification of Telescope Building (U-40)..... 745,000

This project provides for converting an obsolete telescope building to a radar operations laboratory. It will require the demolition of a portion of the building; modifying the second floor radar area with exterior walls and roof; extending the existing concrete pedestal to support mobile radar equipment antenna above the new roof; rehabilitating the office and laboratory areas, installation of central HVAC; lighting, replace floors, install windows and doors, replace existing roofing and new finishes in the interior of building. This building is currently not in use, but is structurally very sound. The modification will enable mobile radar crews and equipment to relocate from Wallops Island to the Mainland to a secure and adequate structure. It will satisfy a safety consideration of nonessential personnel housed on the launch range, remove crews from a storm hazard area as well as provide them with necessary shop space.

M. Various Locations..... \$435,000

1. Modification of Air Conditioning Systems, Various Buildings,
Goldstone, California..... 275,000

This project provides for modifications of the air-conditioning systems for Control Building G-51, and Laboratory/Office Building G-60 at the Goldstone Deep Space Communication Complex, Venus Site. The work includes removal of existing obsolete direct expansion cooling system and installation of centralized chilled water system. The new system will consist of two chillers, three air handlers, chilled water storage tank, pumps, piping, and automatic control systems. The existing equipment is 25 years old. Degradation in efficiency due to aging combined with high maintenance costs and scarcity of spare parts makes system replacement necessary. These facility modifications will provide enhanced operational efficiency and reliability in support of antenna operations.

2. Modification of Powerhouse, Mars Site, Goldstone, California..... 160,000

This project provides for electrical modifications to the Powerhouse Building at the Mars Site, Goldstone. The work includes modification and replacement of transformers, meters, cables, switchgear, and breakers to allow more efficient operation of the existing generators. Also provided is the addition of one 150 kilowatt diesel engine generator (Echo Site) dedicated to critical power requirements for tracking systems and communications. The Goldstone Deep Space Communications Complex has undergone extensive changes during the last ten years which have greatly increased the complex electrical power requirements that necessitate improved utilization of existing generator capacity.

MISCELLANEOUS PROJECTS NOT IN EXCESS OF \$150,000..... \$1,290,000

Total \$34,000,000

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

An estimated \$34,000,000 to \$40,000,000 per year will be required for continuing rehabilitation and modification needs.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

SUMMARY

MINOR CONSTRUCTION

Summary of Project Amounts by Location:

	<u>Amount</u>	<u>Page No.</u>
Ames Research Center.....	\$ 490,000	CF 15-2
Dryden Flight Research Facility.....	490,000	CF 15-3
Goddard Space Flight Center.....	420,000	CF 15-3
Jet Propulsion Laboratory.....	840,000	CF 15-3
Johnson Space Center.....	870,000	CF 15-4
Kennedy Space Center.....	1,560,000	CF 15-5
Langley Research Center.....	1,420,000	CF 15-6
Lewis Research Center.....	980,000	CF 15-7
Marshall Space Flight Center.....	1,130,000	CF 15-7
Michoud Assembly Facility.....	440,000	CF 15-8
Stennis Space Center.....	910,000	CF 15-8
Wallops Flight Facility.....	490,000	CF 15-9
Various Locations.....	<u>960,000</u>	CF 15-9
Total.....	<u>\$11,000,000</u>	

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CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Minor Construction of New Facilities and Additions to Existing Facilities,
Not in Excess of \$500,000 Per Project

INSTALLATION: Various Locations

FY 1991 CoF Estimate: \$11,000,000

FY 1989: \$9,000,000

FY 1990: \$10,000,000

COGNIZANT INSTALLATIONS/LOCATIONS OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management

SUMMARY PURPOSE AND SCOPE:

These resources will provide for minor facility construction at NASA field installations and Government-owned industrial plants supporting NASA activities. Each project included in this program is estimated to cost not more than \$500,000 and involves either the construction of new facilities or additions to facilities. The FY 1991 request of \$11,000,000 will improve the usefulness of NASA's physical plant by changing the utilization of or augmenting the capabilities of various facilities. Included in this request are those programmatic and institutional projects that are essential to the accomplishment of mission objectives.

PROJECT JUSTIFICATION:

The configuration of NASA's physical plant necessarily must respond to changes in utilization and adaptations required by changes in technology or in mission needs. Demands are generated by research, development, test, and similar activities. Specific justification for each minor construction project is provided under "PROJECT COST ESTIMATE."

PROJECT DESCRIPTION:

Included in the FY 1991 minor construction program are those facility projects for institutional or technical facility needs which could be fully identified at the time of submission of this budget estimate. Items of work totalling \$11,000,000 are included in this resource request and have been distilled from a list totalling over \$25,000,000. Projects were selected on the basis of the relative urgency of each item and the expected return on the investment. During the course of the year, the revision of priorities may require changes in some of the items to be accomplished. Such changes will be accommodated within the total resources allocated.

These projects represent requirements that must be met in this timeframe to support institutional needs and programmatic objectives. The following listing summarizes the cost distribution by category of work:

a. General Purpose Buildings.....	\$2,750,000
b. Technical Buildings/Structures.....	\$7,620,000
c. Pavements.....	\$ 630,000

PROJECT COST ESTIMATE:

A. <u>Ames Research Center</u> (ARC)	<u>\$490,000</u>
1. Construct Office, Space Science Research Laboratory (N-245).....	490,000

This project will provide an approximately 3,600 gross square feet extension with offices and computer lab over an existing machine shop. This addition is required to meet Agency needs in infrared astrophysics, Earth sciences and planetary sciences. It will house a computer graphics laboratory interfacing with the Numerical Aerodynamic Simulation Facility and provide temperature regulation of the machine shop. Present facilities are saturated, and there is a projected 15 percent increase in resident staff over the next 5 years (approximately 30 persons). It is essential that this space be provided to continue the high caliber of associations with the academic community.

B. <u>Dryden Flight Research Facility (DFRF)</u>	<u>\$490,000</u>
1. Construction of Audio/Video Support Center.....	490,000

This project will construct an audio/video support center consisting of 6,000 square feet of pre-engineered steel building, utility service connections, 1,800 square yards of asphalt paving for drives and parking, and high voltage electrical service at this new building site. This function is currently located in scattered temporary trailers and other substandard quarters. This project will consolidate the function, and eliminate temporary facilities replacing them with modern, efficient, permanent structures.

C. <u>Goddard Space Flight Center (GSFC)</u>	<u>\$420,000</u>
1. Construction of Truck Lock/Staging Facility of Building 5.....	420,000

This project provides for the expansion of the Instrument Construction and Installation Laboratory, Building 5, truck lock serving the west high bay area. This construction will include a 1600-square-foot addition to the north side of existing truck lock W-59. A 12 foot wide roll up door will be required for access to the truck lock. In addition, this project construction will also include architectural, electrical and mechanical provisions for a 1,200-square-foot staging area adjacent to the existing Diffraction Grating Evaluation Facility (DGEF) in the north end of Building 5. Demands for truck lock/staging area facilities will increase as payload activities increase. This expansion will alleviate the critical lack of truck lock/staging areas that would develop in the 1990's.

D. <u>Jet Propulsion Laboratory (JPL)</u>	<u>\$ 840,000</u>
1. Construct Stormwater Drainage System Frequency Standards Laboratory.....	350,000

The project requires the construction of a storm drainage system which will consist of a 12-foot-high debris basin with a 5-foot riser outlet and a gunite spillway. The debris basin will be located across the valley just northeast of Building 298. The riser outlet and the spillway will discharge into the inlet structure of existing concrete channels. The project also requires the restoration to original condition of the channels undermined by overflow due to debris collection. The run-off from approximately 3.5 acres of foothill area drains towards Building 298. The water and high volume of fast moving debris has resulted in the undermining of the channels due to overflow and will damage Building 298 by impact and accumulation if left unchecked. This project will protect Building 298 and allow controlled flow of water into existing channels.

2. Construction of Addition to Table Mountain Administration Building (TM-17)..... 490,000

This project provides for the construction of a two-story addition of approximately 3,500 square feet to Building TM-17 at Table Mountain Observatory. This addition will consist of sleeping quarters, bathrooms and working desk space. The offices will be designed to double as sleeping quarters in the event of overflow. The addition will match the existing adjacent concrete masonry and wood frame construction and include heating, ventilating, and air conditioning (HVAC), electrical utilities and communication, water and sewer services. With the completion of the 40-inch telescope, and the addition of the 48-inch telescope and its associated Planetary Research Facility, the use of the Table Mountain facility will increase significantly. With this increased telescope usage, it will be necessary to support more scientists that will be conducting their research at the Table Mountain site. The existing on-site facilities cannot support the additional personnel.

E. Johnson Space Center (JSC)..... \$870,000

1. Construct Hypervelocity Test Enclosure, White Sands Test Facility..... 420,000

This project provides a facility to house the light gas gun and an underground data acquisition and control bunker to replace the portable bunker at the existing Hypervelocity Impact Facility. The facility, a 30-by 100-foot pre-engineered metal building, will be situated on an existing 40-by 250-foot concrete pad and will include HVAC systems. A gantry crane, and a work area for cleaning the gas gun and maintaining the range assembly will be included. The underground bunker will be reinforced concrete and will include HVAC provisions. This project is necessary to provide a permanent shelter with controlled climate for the operation and maintenance of the light gas gun. Hypervelocity impact testing of vessels pressurized with hazardous fluids such as oxygen, hydrogen, ammonia, and hydrazine, as well as toxic materials such as cadmium and beryllium will be accomplished in support of the Space Station Freedom program.

2. Construct Addition to Emergency Center Building, White Sands Test Facility..... 450,000

This project provides for a two-story addition to the existing Emergency Center Building, Facility 112. The new addition will comprise approximately 6,000 square feet and will be constructed of concrete masonry matching the existing one-story structure. This addition is necessary to provide a live-in area for emergency personnel, garage space for emergency vehicles, and expanded examining and treatment rooms in the dispensary. The existing Emergency Center Building was constructed in 1964 and is no longer adequate

to meet the current requirements for emergency services. Emergency services personnel are now housed in several mobile homes which have reached the end of their useful life. New fire trucks and ambulances have been acquired, but existing garage space is inadequate. Also, the examining and treatment rooms require expansion to make room for additional equipment.

F. Kennedy Space Center (KSC) \$1,560,000

1. Construct Addition to Occupational Health Facility 430,000

This project provides for the construction of an approximately 5,000-square-foot addition to the KSC industrial area occupational health facility. The existing administrative area will be relocated to the new section of the building which will also include a logistics and drug area, a training and conference room and a new mechanical room. This project is required because of overcrowding and inefficient operational conditions which now exist in the present facility. Due to the increasing number of employees and the requirement to perform more physical examinations, the existing facility does not have space to accommodate the increased workload.

2. Construct Road to Vehicle Assembly Building (VAB) Solid Rocket Motor Segments..... 280,000

This project provides lightning protection for the Solid Rocket Motor (SRM) segments during transit between the SRM rotation and surge buildings and between the rotation building and the VAB. Such direct, quick access will reduce the risk to SRM segments from static discharge during transport to the VAB for stacking. Currently it takes approximately one hour to transport an SRM segment through the OPF operational area.

3. Construct Environmental Health Facility Annex..... 360,000

This project provides for the construction of a 3,600-square-foot addition to Building L7-1557 to provide additional office and work area for the environmental health staff. The work includes a power, lighting, HVAC, and fire protection/detection. This additional centralized office work area is required for growing environmental health operations. The existing space is congested and additional space is needed to store records and conduct computer operations. In addition, the facility has been cited by fire and safety as being overcrowded and a fire hazard.

4. Construct Banana Creek Viewing Site..... 490,000

This project will enhance the launch viewing site on the Banana Creek near Astronaut Road by paving the access roads and bus parking lots, installing a water line, and constructing a toilet facility and sidewalks. This viewing site is required to support guests at Shuttle launches. The existing viewing area at the LC-39 press site is no longer available due to the increased media requirements for parking and support. In addition, a more private viewing site is needed for astronaut families and guests as recognized after the 51-L accident.

G. Langley Research Center (LARC)..... \$1,420,000

1. Construct Aircraft Acoustics Research Facility Addition (1208)..... 490,000

This project provides for construction of an approximately 4,500-square-foot addition to the existing Aircraft Noise Reduction Laboratory (1208) to house Applied Acoustics Branch personnel. The facility will include provisions for a future second and third floor. The project includes a covered walkway, utility connections, site improvements and landscaping. This addition will provide adequate secure office space for a research branch to perform classified research and will consolidate most acoustic researchers activities, thus promoting the coordination, working efficiency, and professional interaction of those involved in similar research problems.

2. Construct NDE Testing/Ultrasonic Cleaning Addition (1296)..... 440,000

This project will provide for construction of an approximately 2,250 square feet addition to the existing Materials Properties and Nondestructive Evaluation (NDE) Laboratory (1296). Included will be a new shop area for an ultrasonic clean pit and space for dye penetrant, magnaflux, eddy current, visual, thickness, and other bench-type NDE operations. A 12-foot ceiling height is required in the new facility to accommodate a monorail hoist for routine hardware handling. The project includes the necessary modifications to the existing building for the addition, utility connections, site work and landscaping. This project will consolidate nondestructive testing operations under one roof, eliminate a number of existing safety problems, and reduce the overcrowding of equipment and personnel in the main shop for the NDE group.

3. Construct Low-Speed Aerodynamics Research Tunnel Laboratory..... 490,000

This project provides for construction of a one-story building, approximately 5,075 square feet for the Basic Aerodynamics Research Tunnel (BART). The BART is an open-return wind tunnel with a test section 28 inches high, 40 inches wide and 10 feet long, and a maximum flow velocity in the test section of 220 feet per second. The project will enclose the main tunnel area, control room, office, storage space, shop and setup

areas with an adequate structure. This will reduce costly inefficiencies caused by downtime during wet weather and by separation of the tunnel researchers. The safety of personnel and the protection of expensive research equipment will also be improved.

H. <u>Lewis Research Center (LeRC)</u>	<u>\$980,000</u>
1. Construction of Addition, Building (309).....	490,000

This project provides for the construction of a 3,100-square-foot one floor addition to the Space Power Research Laboratory (SPRL) (309). The work includes: demolition, utility work, construction of open plan offices and entrances along with structural steel framing; reinforced concrete foundations and floor slabs; heating, air conditioning, plumbing and electrical systems. The exterior materials will match the existing construction. This building addition provides the necessary space to relieve overcrowded and confined conditions in the laboratory areas of the SPRL building. The addition will enable the researchers to remove their desks and workstations from the laboratories into the new adjacent areas, thus freeing valuable laboratory space for research requirements.

2. Construction of Secure Buildup Area, Building (102).....	490,000
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The project provides for the construction of a new secure buildup area at the Engine Components Research Laboratory (ECRL), Building 102. The work includes construction of a new secure model instrumentation and buildup area, including necessary structural, mechanical and electrical systems. Additional work includes the installation of new 6-inch diameter 450 psi combustion air lines to provide independent supply to cells 1 and 2 and other miscellaneous mechanical, electrical and structural modifications. The secure buildup area will permit classified DOD and NASA aeronautics testing. In addition, the work will enable more efficient operation of the two cells in this facility.

I. <u>Marshall Space Flight Center (MSFC)</u>	<u>\$1,130,000</u>
1. Construct Addition to Flammability Test Facility.....	470,000

This project provides additional space to meet the increased frequency and sophistication of material flammability testing in a high pressure oxygen environment. Scope includes a 1,600-square-foot addition matching the existing walls, floor and ceiling treatments of the existing Building 4623. The preponderance of testing today is in high pressure environments; separation of the high pressure oxygen from the low pressure testing is deemed essential to assure safety of personnel and equipment.

2. Construct Addition to Computed Tomography Control Room..... 300,000

This project provides a 1,200-square-foot addition to Building 4707 for a control room in support of the newly acquired Computed Tomography (CT) system. Scope includes raised flooring, minimal office space, dedicated temperature and humidity control, regulated power supply and safety required access controls. This addition will resolve the operational problems which have resulted from fitting the CT system into space previously occupied by a smaller x-ray system.

3. Construct Radiographic Inspection Cell..... 360,000

This project provides a 1,400-square-foot addition to Building 4702 for a radiographic inspection cell. Scope includes thick concrete wall to provide radiation shielding, an adjacent film storage and processing suite, and an adjacent operations room. An overhead crane system is included, as is a film processor which must be built into the structure. This facility will reinstate x-ray capability in excess of 150 keV which was lost when displaced by the recent installation of other equipment.

J. Michoud Assembly Facility..... \$440,000

1. Construct Shelter for Equipment/Material Storage..... 440,000

This project provides for construction of a covered and enclosed shelter near Building 404 Maintenance Shop. Scope includes a three sided roofed metal shelter of 6,800 square feet and a 1,200-square-foot enclosed shelter, both with minimal overhead lighting and electrical service. This project will extend the life of heavy equipment by protecting it from the elements. The enclosure will also secure grounds maintenance small tools and chemicals.

K. Stennis Space Center (SSC)..... \$910,000

1. Addition to Standards and Calibration Laboratory..... 420,000

This project provides for an addition to Building 8110 to accommodate the Electronics Calibration and Repair Laboratory. Scope includes a 6,300-square-foot concrete masonry facility with stringent heating, air conditioning and humidity controls. Both regulated and unregulated power will be supplied. The new facility will replace the undersized and environmentally unsatisfactory area currently housing this function in Building 8100. The increased size is required to meet the equipment calibration needs of the expanding Stennis Space Center role in propulsion systems research and development.

2. Construct Technical Support and Engineering Facility..... 490,000

This project provides for construction of a building allowing consolidation of the 116 members of the Stennis Space Center Technical Services Support Contractor's Engineering and Service Department (ESD). Scope includes a 6,400-square-foot pre-engineered steel building with an office environment. ESD personnel are currently spread between eight remote locations. These locations are overcrowded and cannot accommodate the additional staffing required to address the increasing engineering services workload associated with the Stennis Space Center's growing mission in space propulsion technology.

L. Wallops Flight Facility (WFF)..... \$490,000

1. Construction of Addition to Test/Evaluation Facility (F-10)..... 490,000

This project provides for the construction of a 5,120-square-foot two-story pre-engineered metal building addition to the Test and Evaluation Facility. The work includes removal of the existing concrete apron and the erection of an insulated, pre-engineered metal building addition with all necessary utilities, a freight elevator and a three-ton monorail hoist will also be included. The space in this building will be jointly utilized by the Experimental Electronic Construction Section and the Test and Evaluation Section to provide support for sounding rocket projects. They will provide electronic fabrication, functional testing, integration, and simulated flight environments for testing payloads/payload components. The new structure will provide timely response to current Sounding Rocket Program requirements and improve quality and cost effectiveness. The new space is essential to accommodate the increased program requirements.

M. Various Locations..... \$960,000

1. Construction of Logistics Buildings, Mars Site, Goldstone, California..... 470,000

This project provides for the construction of a single-story building of approximately 3,100 square feet for housing the logistics operations and personnel at the Mars Station (DSS-14). Construction will consist of site development, utilities, prefabricated building, and mechanical/electrical systems. This project will improve the overall efficiency of the logistics support for the maintenance and integration staff by relocating the principal logistics and supply center from the Apollo site to the Mars site where the bulk of the maintenance and technical support is required. This will improve maintenance response time and reduce systems downtime.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

SUMMARY

FACILITY PLANNING AND DESIGN

	<u>Amount</u>	<u>Page No.</u>
<u>Regular Requirements:</u>	<u>\$15,600,000</u>	
Master Planning.....	300,000	CF 16-2
Sustaining Engineering Support.....	1,100,000	CF 16-2
Preliminary Engineering Reports and Related Special Engineering Support.....	3,900,000	CF 16-4
Final Design.....	10,300,000	CF 16-5
<u>Other Requirements.....</u>	<u>\$12,400,000</u>	
Space Flight Facility Planning and Design.....	4,900,000	CF 16-5
Aeronautical Facilities Revitalization Facility Planning and Design.....	3,800,000	CF 16-6
Space Station Freedom Facility Planning and Design.....	3,700,000	CF 16-6
Total.....	<u>\$28,000,000</u>	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Facility Planning and Design

FY 1991 CoF Estimates: \$28,000,000

FY 1989: \$22,000,000

FY 1990: \$26,300,000

The funds requested in this estimate are required to provide for the following advance planning and design activities related to facilities activities and projects:

a. The accomplishment of necessary development and master planning for field installations and, where not otherwise provided for, the provision of continuing engineering support and special engineering management and other services.

b. The preparation of preliminary engineering reports, cost estimates, and design and construction schedules.

c. The preparation of final construction plans, specifications, and associated cost estimates and schedules required to implement construction projects.

d. The accomplishment of facilities siting and other investigations, studies and reports, where not otherwise provided for.

Regular requirements encompass the basic purposes outlined above. The "other requirements," while also in support of "regular" purposes, cover those special needs related to large, complex projects or specific

programs considered to represent high potential future construction requirements for which early definition is essential. The large projects require more planning and longer lead time. Much of this planning must be completed prior to inclusion of the project in a budget request.

1. REGULAR REQUIREMENTS..... \$15,600,000

A. Master Planning..... 300,000

Provides for update and development of existing field installation master plans. This effort includes facility studies, site investigations, and analyses of utility systems. The master plan documents will be updated to reflect as-built conditions and to graphically represent the 5-year facility plan baseline for future development.

The NASA field center master plans are generally updated at 4-to-5-year intervals. On an agencywide basis, the level of effort remains fairly constant. The master plans are essential as reference documents for land use planning, identification of physical relationships of facilities, and proper orientation and arrangement of facilities. Representative candidates for FY 1991 master planning are as follows:

(1) Stennis Space Center

An update of the facilities inventory base to include new NASA and major tenant facilities with emphasis on changes caused by recent facility planning, construction, and modifications.

(2) Dryden Flight Research Facility

An update to reflect as-built conditions of facilities and utilities, revised land use planning, and changes to 5-year planning.

B. Sustaining Engineering Support..... 1,100,000

Provisions for facility studies and specific engineering support continue in importance as evidenced in recent years, and must be given high priority throughout FY 1991. These efforts are important due to changing cost trends in construction materials and fuels; the continuing importance of energy conservation and efficiency; and the operation and maintenance costs for the physical plant.

The following items are included in the FY 1991 requirements:

(1) Building Research Board

Covers annual support to the Federal Construction Council's (FCC) operations and provides for special studies that the Council will perform throughout FY 1991 to help advance the science and technology of Federal Government building and construction. The FCC is subordinate to the Building Research Board, National Academy of Sciences, and its activities are supported by NASA and several other Federal agencies.

(2) Utilities Services/Rates Analysis

Provides resources for the support of utilities procurement and utilities control systems. This support includes, but is not limited to, technical assistance, surveillance, and recommendations with regard to utility rates, contract negotiations, and systems operations, including control systems to manage utilities usage efficiently.

These resources enable the agency to ensure that fair and reasonable rates are charged under its major utility contracts. Essential and valuable technical assistance is provided to our field installations so that effective negotiations can be conducted with utility companies. Several major utility contracts per year require technical assistance as utility contracts are renewed throughout the agency.

(3) Facility Operation and Maintenance Analysis

Provides for continued engineering support for implementing improvements at NASA field installations relative to manpower utilization, work control systems, preventive maintenance, facilities management and reporting systems. Improvements will also involve techniques to identify where and how increases in productivity are possible. Included in this activity are field surveys to be conducted on a priority basis at selected NASA field installations to evaluate the effectiveness and efficiency of the operations and maintenance management systems.

(4) Value Engineering Cost Validations and Analyses

Provides for engineering services to improve cost-effectiveness of facility projects by subjecting project design criteria, specifications and working drawings for specific material components and systems to a detailed independent review by engineering specialists in the particular area of involvement. Also provides services necessary to predict accurately and validate facility costs which will aid in resources planning for the various field installations.

(5) Facilities Utilization Analyses

Provides for the analyses of agencywide facilities utilization data covering (1) office and other types of building space; (2) designated major technical facilities; and (3) special studies comparing the utilization of technical facilities which are similar in type or capability, such as wind tunnels. Such analyses provide for (1) insights into and development of better methods of identifying underutilized facilities; (2) improved techniques to quantify level of facilities use; and (3) actions to improve facilities utilization. Work provides for review of each installation's inventory data base in support of the facilities utilization program. Surveys are necessary to validate the reported data in relation to a specific problem or need, and to assist in providing a credible foundation for plans to improve the utilization of facilities.

(6) Independent Analysis and Third Party Reviews

Provides the technical and engineering support, analyses, designs, and reviews required to verify, confirm and ensure suitability of construction designs or techniques relating to complex projects that involve high risk, safety or other significant considerations.

C. Preliminary Engineering Reports and Related Special Engineering Support..... 3,900,000

(1) Preliminary Engineering Reports (PER's)..... (3,400,000)

This estimate provides for preparation of PER's, investigations, and project studies related to proposed facility projects in the FY 1993 and FY 1994 Construction of Facilities programs. These reports are required to permit the early and timely development of the most suitable project to meet the stated programmatic and functional needs. Reports provide basic data, cost estimates and schedules relating to future budgetary proposals. This request provides for PER's associated with proposed construction, except as provided for in other requirements (paragraph 2) for Space Flight, Space Station, and Aeronautical Facilities Revitalization initiatives.

The estimated cost of PER support for FY 1993 construction projects is \$2,900,000 which will permit updating of PER's for \$45-60 million in construction, and the development of new PER's for an additional \$110-140 million in projects.

An additional \$500,000 has been included in this line for the completion of new PER's for approximately \$20-25 million of construction projects which will be high priority candidates for inclusion in the FY 1994 Construction of Facilities program. The activity associated with FY 1994 will be confined to the highest priority candidates.

(2) Related Special Engineering Support..... (500,000)

This estimate provides for investigations and project studies related to proposed facility projects to be included in the subsequent Construction of Facilities programs. Such studies involve documentation and validation of "as-built" conditions, survey/study of present condition of such items as roofing and cooling towers, utility plant condition and operational modes, analysis and support of environmental impact assessments and statements, and other like studies. These studies are required to allow for the timely development of projects to meet the stated functional needs and to provide basic data, cost estimates and schedules for related future budgetary proposals.

D. Final Design..... 10,300,000

The amount requested will provide for the preparation of designs, plans, drawings, and specifications necessary for the accomplishment of projects other than Space Flight, Aeronautical Facilities Revitalization and the Space Station Freedom. Amounts required for those efforts are included under other requirements. Projects involved are planned for inclusion in the FY 1992 and FY 1993 programs. The goal is to obtain better facilities on line earlier at a lower cost.

The request will provide for final design work associated with construction proposed for the FY 1992 Program, estimated to cost \$120 to \$150 million, and for \$15 to \$20 million of high potential projects proposed for the FY 1993 program. The amount included for FY 1992 candidates and for residual requirements of this nature which have accumulated from prior years' final design activities is \$9,100,000. For FY 1993, \$1,200,000 is included and design activity will be confined to the highest priority candidates.

2. OTHER REQUIREMENTS..... \$12,400,000

Included in this particular request are other facilities planning and design requirements primarily associated with specific space programs characterized by large size, long planning cycle, and/or complexity of scope. These programs require a level of planning effort and length of design time beyond the more routine facility projects. These requirements must be provided beyond the regular and most recurrent facility planning and design needs.

A. Space Flight Facility Planning and Design..... (4,900,000)

These resources provide for early and progressive design, final drawings, specifications, and site investigations for Space Flight facilities in order to ensure the best design, good cost estimates and

realistic construction schedules. The Shuttle operational era requirements include expansion and improvement of Shuttle processing, repair and maintenance facilities that support the launch rate, construction of operations personnel facilities, modification to the launch complex support facilities and modifications at various locations for space engine enhancement and testing.

B. Aeronautical Facilities Revitalization Facility Planning and Design..... (3,800,000)

The amount requested will provide for preparation of preliminary engineering reports and final designs and specifications required for continuation of the Aeronautical Facilities Revitalization Program initiated in FY 1989. This is a structured multi-year effort to restore and modernize NASA's aging aeronautical research and development facilities at various NASA installations. Demand for these unique facilities at various NASA installations is growing and includes the National Aero-Space Plane (NASP) program, research on high-speed civil transports, and a new generation of military aircraft.

C. Space Station Freedom Facility Planning and Design..... (3,700,000)

This requirement is a continuing effort primarily for preparation of preliminary engineering reports and final design drawings, specifications and associated site investigations required for construction of Space Station facilities at various locations. Included are automation and robotics sciences research, space sciences research, solar dynamics simulation, crew training, processing and prelaunch checkout facilities.

Total..... \$28,000,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1991 ESTIMATES
SUMMARY

ENVIRONMENTAL COMPLIANCE AND RESTORATION

Summary of Project Amounts by Location:

	<u>Amount</u>	<u>Page No.</u>
Ames Research Center.....	\$ 2,300,000	CF 17-3
Goddard Space Flight Center.....	400,000	CF 17-3
Jet Propulsion Laboratory.....	2,490,000	CF 17-4
Johnson Space Center.....	2,590,000	CF 17-5
Kennedy Space Center.....	3,600,000	CF 17-5
Langley Research Center.....	400,000	CF 17-6
Lewis Research Center.....	2,100,000	CF 17-7
Marshall Space Flight Center.....	3,860,000	CF 17-7
Michoud Assembly Facility.....	3,360,000	CF 17-8
Wallops Flight Facility.....	2,200,000	CF 17-9
White Sands Test Facility.....	2,800,000	CF 17-9
Miscellaneous Projects Not in Excess of \$150,000 Each.....	1,000,000	CF 17-10
Studies, Assessments, and Design.....	2,100,000	CF 17-10
Remedial Investigations, Feasibility Studies, and Related Engineering.....	<u>2,800,000</u>	CF 17-10
Total.....	<u>\$32,000,000</u>	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1991 ESTIMATES

PROJECT TITLE: Environmental Compliance and Restoration Program

INSTALLATION: Various Locations

FY 1991 CoF Estimate: \$32,000,000

FY 1989: \$26,000,000

FY 1990: \$30,000,000

COGNIZANT INSTALLATIONS/LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management

SUMMARY PURPOSE AND SCOPE:

These resources will provide for studies, assessments, remedial investigations (RI), feasibility studies (FS), related engineering, design and remedial projects for environmental compliance and restoration measures at NASA field installations, Government-owned industrial plants supporting NASA activities and other locations where NASA has been found to have contributed to environmental problems and is obligated to contribute to cleanup costs. In addition, these resources will be used to acquire land if needed to implement these environmental compliance and restoration measures. The purpose of this program is to enable compliance with mandatory statutory environmental requirements and standards. The resources authorized and appropriated pursuant to this program may not be applied to other activities. The program includes such measures as studies or assessments to determine current status and options for remedial action, prescribed RI's and FS's as required by Federal environmental laws, environmental restoration, hazardous waste removal and disposal, cleanup and closures and removal of unsafe buildings and debris.

PROJECT JUSTIFICATION/DESCRIPTION:

Proposed environmental compliance and restoration projects and activities for Fiscal Year 1991 total \$32,000,000 which has been distilled from requests of approximately \$46,000,000. This program represents only a modest request in relation to total requirements for environmental compliance and restoration that must be implemented within the next several years. Based on relative urgency and potential health hazards, the following listed projects are the highest

priority requirements and are currently planned for accomplishment in FY 1991. Deferral of these necessary remedial measures would make it impossible for NASA to comply with environmental law and will cause shutdown of critical NASA operations by individual State or Federal environmental authorities. Studies, assessments, and design costs are approximately \$2,100,000. To comply with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Superfund Amendments and Reauthorization Act (SARA) regulations, necessary RI's and FS's must be performed. The estimated cost for these activities is \$2,800,000. Projects estimated to cost not in excess of \$150,000 have not been described or identified by specific location. The estimated cost of these projects is \$1,000,000.

For those projects greater than \$150,000, the following broad categories of effort will be undertaken in Fiscal Year 1991. As studies, assessments, RI's, FS's, and designs progress and as new discoveries or regulatory requirements change, it is expected that priorities may change and revisions of the activities and projects may be necessary.

- a. Air Pollution Abatement and Asbestos Management \$ 4,310,000
- b. Rehabilitation/Replacement of Polychlorinated Biphenyl (PCB) Transformers \$ 300,000
- c. Hazardous Waste Monitoring and Control \$12,880,000
- d. Replacement of Underground Storage Tanks..... \$ 3,810,000
- e. Rehabilitation/Upgrade of Treatment Systems..... \$ 4,800,000

PROJECT COST ESTIMATE

A. Ames Research Center (ARC)..... \$2,300,000

1. Repair Wastewater Treatment/Oil Water Separator System..... 1,700,000

This project will provide for a wastewater treatment/oil water separator system that will separate the oils and sediments from rain and surface water runoffs prior to its release into the marshlands and San Francisco Bay. There are approximately 50 locations at Ames Moffett where equipment drains, floor drains, sinks, or overflow lines are connected to the storm drainage system. Due to potential oil and fuel spills from normal operational activities, Federal regulations and State of California Regional Water Quality Control Board require that an oil water separator system be in place to eliminate any pollutants discharging into a large waterway. This is to eliminate a non-compliance order that has been issued by the State of California.

2. Provide Secondary Containment/Hazardous Substance Storage..... 600,000

The project will provide hazardous substance storage with secondary containment at various wind tunnel facilities for petroleum products, corrosion inhibitors, cooling water chemical treatment, solvents, hydraulic fluids, paint, and cleaning materials as required by the Federal, State, and Santa Clara County regulations. ARC is in violation for improperly storing and transferring hazardous substances and has been cited by the State of California for non-compliance.

B. Goddard Space Flight Center (GSFC)..... \$400,000

1. Removal and Disposal of Asbestos, Building 24..... 400,000

This project provides for the removal and disposal of asbestos insulation from mechanical equipment, duct work, and piping in Building 24, the Central Heating and Refrigeration Plant. The insulation is heavily damaged and is falling off making repairs and maintenance very difficult and costly. Due to exposed asbestos material in numerous locations and the requirements to continuously maintain and repair the equipment, this condition presents a high health risk within the workplace and may result in a shutdown of GSFC boiler plant operations.

C. <u>Jet Propulsion Laboratory (JPL)</u>	<u>\$2,490,000</u>
1. Cleanup of Arroyo Seco Groundwater Contamination.....	2,000,000

This project provides for the design and initiation of construction of a treatment facility to remove volatile organic compounds from municipal water supplies being taken from the groundwater in the Arroyo Seco aquifer. Previous sampling and testing of groundwater from City of Pasadena water supply wells in the vicinity of JPL have confirmed the presence of trichloroethylene, carbon tetrachloride, and tetrachloroethylene in excess of Federal and State of California standards. Studies have alleged that JPL operations have contributed to the contamination. Ongoing studies are underway to confirm or deny the extent of any JPL responsibility. This is a follow-on increment of a multi-year program that supports JPL's cost sharing contribution towards the Arroyo Seco groundwater contamination cleanup. The City of Pasadena has cited JPL as the source of the groundwater contamination. This site is expected to be added to the next revision to the "National Priorities List."

2. Install Leak Detection System for Catch Basins, Edwards Test Station.....	250,000
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This project provides for lining of the leaking scrubber effluent treatment basin, installation of leak detection monitoring equipment, and installation of a sludge holding basin at Test Stand C. A high density polyethylene liner will be installed for the 175,000 gallon capacity basin along with five monitoring wells that will provide leak detection capability. A 9,000 gallon concrete sludge holding basin will also be constructed adjacent to the treatment basin to facilitate cleaning since suction removal of the sludge is required to prevent any damage of the basin liner material. This will comply with Federal and State of California Department of Health Services regulations requiring that known soil contamination be corrected and cleaned up once it has been identified.

3. Construct Hazardous Materials Storage Facilities, Edwards Test Station.....	240,000
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This project provides for the construction of three 130-square-foot metal buildings for fuel storage. One will be an enclosed building for the storage of solid rocket motor propellants, and the other two will be open sheds for storing liquid fuels. Each building will have a built-in concrete overflow basin to capture any fuel spills. Present facilities do not comply with the State of California hazardous material/waste storage regulations.

D. Johnson Space Center (JSC)..... \$2,590,000

1. Remove and Dispose of Asbestos, Building 2..... 1,500,000

This project provides for the removal and disposal of asbestos containing material in the Auditorium and Public Affairs Facility of Building 2, JSC Visitors Center. The work includes the removal of approximately 58,400 square feet of asbestos fireproofing and 10,500 square feet of acoustical asbestos material that are fully exposed in these areas. The asbestos material is deteriorated and airborne fibers have been detected in this building which accommodates members of the general public, including many children. The existing conditions represent health hazard and must be corrected.

2. Provide Abrasive Blast Facility..... 860,000

This project provides for the construction of a climate controlled abrasive blasting complex comprising approximately 2,400 square feet along with a high bay approximately 40 feet high. The structure includes additional reinforcements and equipment (such as hoists) for managing heavy loads. A raised floor with an abrasive collection and recycling system will also be included. A high efficiency particulate filtration system will be installed to eliminate uncontrolled atmospheric emissions of abrasive and heavy metal particulates. Abrasives blasting is being performed in a manner that violates the State of Texas Clean Air Act. This facility is required to process large mockups and space flight support hardware.

3. Replace Contaminated Sewer Line, Downey..... 230,000

This project provides for the replacement of approximately 1,300 linear feet of heavily deteriorated and contaminated sewer line and five concrete manholes at Downey. Removal of contaminated soil, line resloping and pavement repair are also required. This will correct an elevated sulfide level wastewater deficiency that has been cited by the Los Angeles County Sanitation District.

E. Kennedy Space Center (KSC)..... \$3,600,000

1. Cleanup of Wilson Corners Groundwater Contamination..... 400,000

This project provides for the continuing cleanup of the contaminants of the surficial aquifer to an acceptable level via the construction and operation of a groundwater/hazardous treatment system/facility. Treatment consists of groundwater extraction wells and a pack-tower aeration treatment unit from which treated effluent will be used for land irrigation. The State of Florida has approved the KSC proposed cleanup methodology and has issued a binding consent order requiring completion of remediation by FY 1994.

2. Construct Solid Waste Transfer Station..... 700,000

This project provides for the construction of a centralized solid waste collection facility for Class II wastes prior to disposal at an off-site facility. Work will include construction of a 9,600 square foot pre-engineered metal building, loading dock, scale, parking, power, water, sewage and communications. This project is required to meet State of Florida regulations on the handling and disposal of solid waste.

3. Install Secondary Containment for Hazardous Waste Tanks, Various Locations..... 300,000

This project will retrofit all remaining tanks at KSC to comply with the latest U.S. Environmental Protection Agency regulations governing the design, installation, and use of tank systems for the storage and/or treatment of hazardous waste under the Resource Conservation and Recovery Act. The rules require that all new or existing tanks and associated piping have secondary containment with interstitial monitoring. The tanks store hydrazine, nitrogen tetroxide, and freon to support critical Space Shuttle facilities. The work is required to meet mandated compliance dates.

4. Close and Cap Ransom Road Landfill..... 2,200,000

This project will clean, fill, regrade, and construct a multilayer cap over 10 acres of the existing Ransom Road landfill. The landfill cap will consist of five layers including an earthen base cap, a cover/buffer cap, an impermeable synthetic membrane (polyvinyl chloride, 30 mils thick), and two additional earthen layers. A gas collection system will be incorporated into the cap, and the cap surface will be stabilized by seed and mulch. This will complete remedial action for the closure of the landfill in accordance with the approved State of Florida Department of Environmental Regulations closure plan.

- F. Langley Research Center (LaRC)..... \$400,000

1. Provide Hazardous Waste Transport Storage Facility..... 400,000

This project provides for a new central hazardous waste transport storage facility. The facility will include the segregation of hazardous waste, separate equipment storage area, eye wash and shower, fire sprinkler and alarm, and secondary containment. This is to comply with the State of Virginia hazardous waste disposal regulations. No adequate storage facility exists at this time.

G. Lewis Research Center (LeRC)..... \$2,100,000

1. Repair/Remediation of Industrial Waste Sewer System..... 600,000

This project provides for repairs to the industrial waste sewer system. TV inspection of the sewers has found broken segments and loose joints as well as root intrusion, all of which may be allowing industrial wastes to exfiltrate to the surrounding soil. The project will rehabilitate sewer segments and manholes in-situ where possible, replace segments where necessary, and remediate any soil contamination that may have resulted from leaks in the lines. The leaking lines are in violation of state and Federal regulations.

2. Replace Leaking Underground Storage Tanks, Various Locations..... 1,200,000

This project provides for the removal, replacement, and disposal of approximately 40 underground storage tanks that are either leaking or heavily deteriorated at Lewis and Plum Brook. The new tanks will include a leak detection system and secondary containment. This will comply with the Federal and State of Ohio underground storage tank regulations which require initiation of corrective actions by December 1990.

3. Replace Polychlorinated Biphenyl (PCB) Transformers, Plum Brook Station..... 300,000

This project provides for the removal, disposal, or replacement of approximately 32 inactive PCB-contaminated transformers at Plum Brook. Most of these PCB-contaminated transformers are inactive but are still mounted on electrical distribution system poles. Federal and Ohio EPA inspections have cited these transformers as being improperly stored, requiring removal and disposal.

H. Marshall Space Flight Center (MSFC)..... \$3,860,000

1. Construct Central Industrial Wastewater Treatment Facility..... 2,500,000

This project will provide a new central wastewater treatment plant that will handle approximately 500,000 gallons per day of normal industrial wastewater now being discharged to the industrial sewer without treatment. The existing Wastewater Treatment Facility can only handle approximately 20 percent of MSFC normal operations. In addition to treatment facilities, the new treatment plant will include wastewater equalization tanks, a chemical storage building, an office, and instrumentation and control center, a laboratory and a pre-treatment module with a 50,000 gallon per day capacity for removal of metals, cyanide, phosphates, and toxic organics. The new treatment plant will treat all of the current wastewater from the metal plating/finishing building and the industrial sewer system. Current operations are in violation of Federal and State wastewater discharge standards.

2. Cleanup of Groundwater Contamination Source, Santa Susana Field Laboratory..... 1,000,000

This project will continue the closure and cleanup of 5 surface impoundments at Santa Susana Field Laboratory which have been determined to be a major source of groundwater contamination within the Lab. NASA owns approximately 460 acres of the total 2,600 acres of land at the Santa Susana complex. Results from studies have shown heavy concentrations of trichloroethylene exist in the groundwater system. The cleanup uses a pump and treat system with air strippers to remove the contaminants from the groundwater. This project will expand pilot plant operations which have been shown to be effective into full-scale operations. The work is being performed in accordance with a compliance order negotiated with the State of California.

3. Upgrade Hazardous Waste Storage Area, Santa Susana Field Laboratory..... 360,000

This project will provide a bermed concrete covered storage area of approximately 115 feet x 60 feet x 20 feet. This facility will be segregated into four areas to properly store ignitable, reactive, and corrosive (acid and base) wastes. A "Notice of Violation" has been issued by the California State Department of Health Services for existing hazardous waste storage deficiencies.

I. Michoud Assembly Facility (MAF)..... \$3,360,000

1. Modify Chemical Waste System, Building 103..... 1,400,000

The project provides for installing an aboveground hazardous chemical waste pipeline (at 40 feet height) with secondary containment and leak detection system to replace a leaking 2100-foot-long underground pipeline system in Building 103. This also includes a new collection tank and sump. This hazardous chemical waste collection system is required to comply with the Resource Conservation and Recovery Act.

2. Replace Underground Chemical Storage Tanks..... 410,000

This project provides for replacing six existing leaking underground storage tanks with new aboveground tanks along with required secondary containment. The aboveground tanks will include two gasoline tanks, two heptane tanks, one methyl ethyl ketone tank, and one xylene tank. This is to comply with Federal and Louisiana State storage tank regulations which are currently being violated.

3. Replace Asbestos Insulation and Roof for Building 351..... 1,550,000

This project provides for removal of approximately 35,000 square feet of spray-applied asbestos insulation covering the structural I-beams located above the metal ceiling in Building 351, the Main Cafeteria. This will also include replacement of the contaminated ceiling and lighting system, re-insulation,

and replacement of the four-ply roof system. Both the roof and asbestos insulation are badly deteriorated. Roof repairs cannot be accomplished without first removing the asbestos material. Failure to do so will create airborne asbestos, violating Federal air pollution regulations and presenting a serious health risk to exposed personnel.

J. Wallops Flight Facility (WFF)..... \$2,200,000

1. Remove Leaking Aviation Fuel Storage Tanks, Various Locations..... 1,500,000

This project provides for the closure and remedial cleanup of the Aviation Fuel Farm which includes removal of 14 aviation fuel storage tanks, 5 pumphouses, 2 fill stands, and 3 heating oil tanks. Several petroleum related contaminants have been detected in the groundwater that indicate leaks from past tank farm activities. This corrective action must be taken in order to conform with Federal and Virginia State Water Control Board regulations. This site is expected to be contained in the next issuance of the National Priorities List.

2. Repair Aircraft Fueling Tanks and Wash Aprons..... 400,000

This project provides for the relocation and modification of the aircraft washing and mobile fueling storage areas on the west side of Hangar D-1. The work includes installation of 21,000 square feet of 8 inch thick concrete pad sloped to the central drains, with a storm sewer connected to a 1,000 gal/min oil water separator, and 500 gallon hazardous waste storage tank and drainage lines to the existing storm drain and sanitary sewer. Several oil contaminants have been detected in the storm drainage lines attributed to aircraft fuel leaks from fuel loading trucks and runoff from aircraft washing area. This project will bring the aircraft area into compliance with the Clean Water Act and Virginia State Water Control Board regulations.

3. Provide Secondary Containment to Aboveground Storage Tanks..... 300,000

This project provides secondary containment for 23 aboveground fuel oil storage tanks of various sizes. This is being performed in accordance with Federal and State of Virginia storage tank regulations.

K. White Sands Test Facility (WSTF)..... \$2,800,000

1. Groundwater Contamination Assessment and Cleanup..... 2,000,000

This is a continuing effort to define the extent, impacts, and possible remedial approaches for groundwater and soil contamination existing at WSTF and affected offsite areas. This phase of the project

includes continued definition and analysis of offsite contamination and public health risks resulting from areas 200, 300, 400 and 600 and from onsite solid waste management units. The majority of the work consists of installation of monitoring wells as required to define the horizontal and vertical contamination characteristics of the groundwater and related soil borings, data analyses, computer models, and engineering/chemical analysis. This will also provide interim measures which will be incorporated as part of the remedial action. The work is required under the Resource Conservation and Recovery Act and is a major constituent of an EPA consent order currently under negotiation.

2. Upgrade Propellant Waste Treatment Facilities..... 800,000

This project provides for modification of the propellant waste treatment facilities in the 300, 400 and 800 areas at White Sands Test Facility. The existing fuel neutralization systems will be modified by the installation of an ozone-ultraviolet neutralization plant at each of the test areas. The existing oxidizer waste disposal system will be removed and replaced with a heated carbon and copper reaction system that includes a hot charcoal reduction column and a hot copper plate oxidation column. The process converts mixed oxides of nitrogen to nitrogen and carbon. This is required for the operation of WSTF propellant neutralization and disposal systems to fully comply with Federal and State of New Mexico Environmental Improvement Division regulations.

MISCELLANEOUS PROJECTS LESS THAN \$150,000 EACH..... \$1,000,000

STUDIES, ASSESSMENTS, AND DESIGNS..... \$2,100,000

REMEDIAL INVESTIGATIONS, FEASIBILITY STUDIES, AND PRELIMINARY ENGINEERING..... \$2,800,000

FUTURE CoF FUNDING REQUIRED TO COMPLETE THIS PROJECT:

An estimated \$35,000,000 - \$40,000,000 per year for the next several years will be required for continuing Environmental Compliance and Restoration projects and activities.

END

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